SCIENTIFIC AMERICAN

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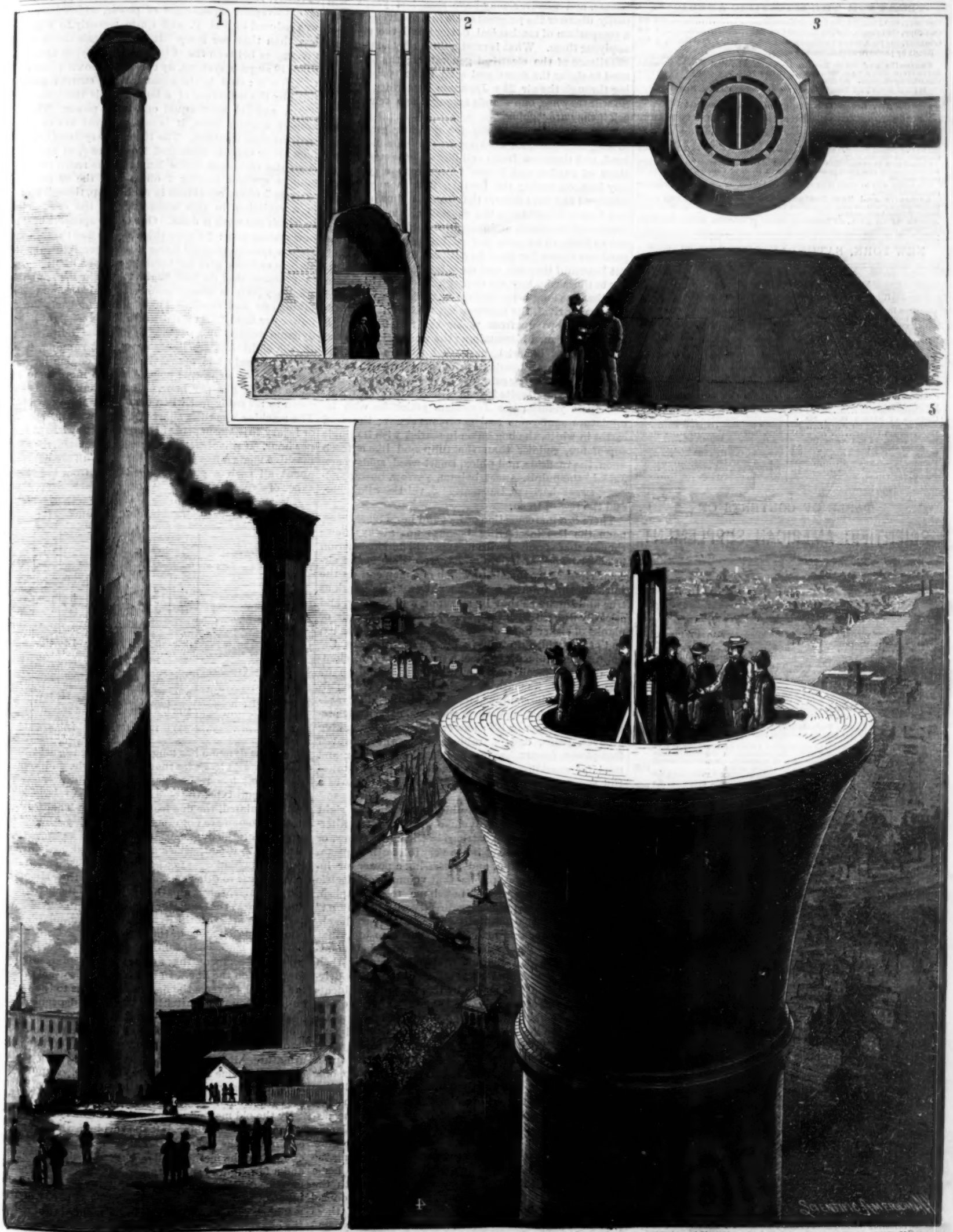

1. Old chimney, height 196 ft.; new chimney, height 355 ft. 2. Vertical section of chimney at base. 3. Horizontal section at level of ground. 4. General view of Newark and surrounding country from top. 5. Metal cap before being mounted.

THE HIGHEST CHIMNEY IN THE UNITED STATES, RECENTLY ERECTED AT THE CLARK THREAD WORKS.—[See page 245.]

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AMERICAN INSTITUTE FAIR.

The visitor to New York, if in the neighborhood of 63d Street and 3d Avenue, might walk by a modest little Dorian entrance on the east side of the street and never suspect he was close upon a great hive of industry, where steam-driven shafting is flying among many curious machines, with stone breakers hammering away, electrical dynamos giving out that mysterious energy which here is setting a hundred lights aglow and there pumping water or pouring silently into a sleeping battery a potentiality that will awaken into light and power when fly wheels are at rest. It is the fifty-seventh annual exhibit of the American Institute, and whoever may have seen last year's will easily discover the progress made in a twelvemonth by a comparison of mechanical devices and the mode of applying them. What is most noteworthy is, perhaps, the silence of the electrical generators; the buzz that used to shake the floors and send bits of paper scooting through the air like Japanese butterflies is gone. So still they are, one stands among them tempted to ask if they are "going."

Then there is machinery for grinding grains and sowing broadcast, for working over the summer fallow land, and there are fruits and flowers—the stereotyped show of garden and house flowers one may see at any fair, or, saving the trouble, find in any florist's window; and wild flowers that are not shown at fairs and florists do not keep, the charming little plants that ornament the woods and paint the fields and hillsides, not so fresh, to be sure, nor so brilliant, as those the gardener shows, for they do not bear plucking so well, yet beautiful they are, and more familiar and interesting to those who love the country. 'Here is the golden rod that has long been turning the fields to gold, and its burning rival, the bitter-sweet, that climbs the hillsides and peeps up from under the rail fences with copper-burnished blossomings; the woolly, long-leaved mullein, that biennial herb that springs from the stoniest pasture, bearing flowers in large terminal racemes; the evening primrose that blooms morning as well as evening despite its name, and with four petals of deepest yellow; the Jerusalem artichoke with its miniature sunflowers and enormous stalks; the wild carrot in white, the bog onion in scarlet with its single cup of fire, ruddier than the tulip and like a torch upon the roadside, and phlox, smart-weed, spiderwort, Jack-in-the-pulpit, sweet balsam, yarrow, butter-and-eggs, sweet barbary, bur-marigold, thistle, wild aster, and the rest of them.

There is a fine collection of foot and hand machinery, none the less interesting because not always new; though those familiar with its type will find instruction in novel devices seen here and there. Here is the circular rip-saw, by the aid of which one man can do the work of three working in the old way; the work as true and square as that by steam or water power, and as easily dressed with the plane. It will rip boards or planks of either hard or soft wood up to 3¾ inches, and of any width up to 19 inches. Then there is the improved combined machine, a scroll saw and a circular one, the scroll saw easily removed while on its mandrel while its mate is being used; the boring attachment for the combined machine with a sliding table for the work, moving on firm ways and carrying it precisely to the auger or bit; new cutter heads for making grooves, gains, dadoes, rabbets, etc.; the improved foot-power former having pedals like a bicycle, and used for moulding brackets, scroll and panel work—the speed of the knives being about 2,000 moves a minute.

There is not, of course, anything novel in the sight of a gas-engine driving a dynamo with the latter alternately working a pump, setting electric lights aglow, or charging a battery. Yet it is a very interesting spectacle, one not easily seen, and possessing a power for instructing the general public that volumes of electric lighting literature could not hope to accomplish. "Why not use the gas-engine directly with the pump?" is the question that naturally suggests itself to the observer. The amiable attendant explains to him that far more power can be got out of the coal when translated into gas and then into electrical energy than when used directly under the boilers of the engine driving the dynamo. He means by this that the residuents of gas making are so valuable that they almost off-set the cost of making the gas, which, because of greater intensity, is a more economical fuel than the coal it is made from. The secondary battery, too, placed as it is on a shelf in clear sight, is an enjoying study in itself. You can see how it is connected up to the dynamo, how cut off; the operation of the little incandescent lights, depending from the ceiling above, glowing when they are connected up with this battery, even when the gas-engine and the dynamo are at rest. Among the lamps overhead sixteen-candle-power lights are made to glow directly from the dynamo: the gas-engine working the latter being of 4 horse power—eight lights to the horse power. But, if the dynamo be connected up with the secondary battery for five hours, then, with all connection with the dynamo cut off, it will feed 50 of these little lamps for several hours, and if then the dynamo is coupled up with its own lamps, there will be 84 aglow, and all, as is obvious, coming indirectly from the energy given out by a 4 horse power gas-engine.

The system of arc lighting used to light up the building at night is wholly new, and in itself will well repay a visit to the exhibition. We are not in a position to verify the statements as to its economy made by its projectors, not having seen any tests, and so are content to give a simple description of the system, repeating what those most interested say for it. The lamp, even to the magnet, is new; the method of regulating quite different from others, and the generator as well. As will be remembered, in the early days of arc lighting the lights were unsteady as well as costly, requiring, most of them, 1½ H. P. per light, an extravagant expenditure of power, which later on was reduced to 1 H. P. and quite recently to a little less than that per lamp. It is easily calculated, this divergence between the 18 to 20 ampere types and the 9·6 to 10 ampere systems, by the well known equation $C^2 \times R = W$; that is, the square of the current multiplied by the resistance of a lamp equals the power in watts, and 746 watts equal one horse power. The 20 ampere systems burn, it is said, a short arc or with carbons close together. The 10 ampere systems burn a long arc or carbons separated from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch. A greater resistance in the lamps is the result; the 20 ampere systems having 2 ohms and the 10 ampere systems 5 ohms resistance in each lamp, though there is a variation in this according to the conditions in which the work is done. One of the sponsors of the new system says: "Under this rule we find that the 20 ampere systems give $\frac{1}{7.33}$ horse power per light, the 10 ampere systems give $\frac{1}{5.18}$ horse power per light. But, in practice, they do not begin to attain 100 per cent efficiency [this is clearly manifest], and we find them taking one and one-half horse power and one horse power per light." At a recent test of a new eight-light dynamo worked by a gas-engine of seven indicated H. P., the eight full arc lights were kept running, it is said, with only 5·18 actual H. P., the engine having ample power to spare; consuming no more than 132 cubic feet of gas per hour. This consumption came down to 102 cubic feet when four lights were cut out. The machine was then short-circuited without sparks or injury to it, the expense of gas coming down to 42 feet per hour. If this statement is not exaggerated, the new machine made a fine showing, for five full arc lights is about all such a gas engine can get from the older types of dynamos.

Here are the figures of this test as given by the makers of a well known gas engine who conducted it:

	Number of lights.					Machine in short circuit.—No. lights.	Engine alone.
	Eight.	Seven.	Six.	Five.	Four.		
Gas consumed per minute.	2·2	2·1	2	1·9	1·7	0·71	0·58
Revolutions of engine per minute	180	180	180	180	180	184	184
Revolutions of dynamo per minute	1,300	1,300	1,300	1,300	1,300	1,320	1,320
Slip of belt	10 p. c.	10 p. c.	10 p. c.	10 p. c.	10 p. c.	10 p. c.	
Actual H. P., including friction	5·18				3 58		
Gas taken per hour in cubic feet	132	126	120	114	102	42·6	34·8

The new dynamo has long bearings for the armature shaft, contains less wire than the old style, and consequently has less resistance. The armature is of the closed circuit type, the core being made of large iron disks, insulated, the one from the other. The brushes on the dynamo are not moved in regulating. The field magnets of the dynamos are saturated to an extent necessary to produce the standard current, and any increase of current does not go around the field magnets, as is the case in other systems, increasing their strength and the current, but a path is provided outside the machine, so that the regulator may adjust the current-producing capacity of the dynamo to the standard, and thus insure the safety of the apparatus. Resistance, it is true, is made use of in regulating, but not for the purpose of compensating for the amount of resistance turned off on the line. In regulating, it is usual to let the current traverse the field magnet coils to the regulator. When the current is increased, dependence is placed upon the controlling magnet of the regulator moving a mechanism and the brushes on the commutator, thus short-circuiting the current through the armature. But the current in the field magnets is always the same as that on the lamp line. Suppose it is not necessary to burn all the lights, and some of them are turned off.

By the old method no reduction can be made in the current in the machine, but the surplus is short-circuited through the armature. This is a heating process, and, while the method will work under slight changes, and a few lights can be turned off with safety, users must be cautioned not to turn off lights below a certain number, say 50 per cent of the rated capacity of the machines; unless the lights can be reduced to one, and the one light be maintained at standard for any length of time on the largest machines, it is not automatic

regulation. With the regulator of the new machine, on the other hand, as each light is turned off, the current in the machine is reduced. So, too, as lights are turned off, the current cannot build up, as is the tendency in other systems, because the source of its induction has less lines of force; the automatic adjustment allowing a sufficient amount of current to pass around the field magnet of the dynamo to produce on the lamp line the standard current. All this is what the projectors of the new system say for it.

A colony of bees is a notable exhibit; the bees, of the yellow striped Italian type, moving restlessly about because of the light coming through the glass case that incloses them and the store they have been laying in all summer. They are "city" honey gatherers, ranging the parks, the flower markets, the private gardens, and window flowering plants instead of the broad fields, and are the more interesting because of this fact. The hive is of the type used by the city bee keepers; a sect little known, yet quite numerous, so it is said. The combs are easily removable without disturbing the workers. Swarming is prevented by a simple device, and the bees safely wintered in their summer stands. The hives are kept upon the house roofs, whence, according to Mr. A. J. King, an authority, the bees range for four or five miles, sometimes as much as 100 lb. of honey being taken from a single hive, with enough remaining to keep the bees through the winter. He says he kept 100 hives for five years on a roof in Park Place, half a block from the Post Office, and with good results.

THE HOME OF THE HOP.

Puyallup valley, the center of the hop industry of Washington Territory, has recently completed the harvesting of an enormous crop, and its farmers are congratulating themselves on the price obtained—twenty-two cents per pound. The total cost, baled and delivered at the railroad, was nine cents, and the yield exceeded one ton to the acre.

The climate and soil of the Territory and of this particular valley are is so well adapted to the growth of the plant, and its freedom from the pests of lice, mildew, and other drawbacks experienced elsewhere is here so uniformly complete, that a maximum annual yield can be depended upon with the same certainty as the summer's sun.

The only "glorious uncertainty" about it is the market price. As this fluctuates from five to one hundred and twenty-five cents per pound, according to the supply and demand, the business is truly exciting.

An extensive grower, with hops at five cents per pound, finds himself unable to meet his liabilities, while the following year the same hop yard may pay a profit of $1,800 per acre if marketed at one dollar per pound.

As the land, cleared of timber and planted with vines, in rows seven feet apart and properly poled, costs $300 per acre, to which must be added a kiln or oven for drying and other paraphernalia, a man of small means can only commence on an extremely small scale.

The picking, which constitutes one-half of the expense of raising, is done by hand and must be paid for in cash every night. It furnishes light and agreeable employment for men, women, children, Indians and Chinese. The two latter excel the whites in rapidity and thoroughness. One dollar per box holding ten bushels is paid for gathering, and nimble fingers are necessary to fill two boxes per day.

The drying of the herb in the ovens is a delicate operation, requiring the experience of an expert, as its proper performance gives value to the commodity.

Experienced Foundrymen on Melting Iron.

BY ROBERT E. MASTERS.

Any one who is about to purchase a foundry cupola, after reading the gilt edge representations in the different circulars and catalogues they receive, is liable to become thoroughly confused about which style to select.

Each of them is represented to do more than any or all the kinds that have ever been operated. On account of some peculiarity in their construction, one is made to believe they cause the wind to do a contortion act or go through some performance that "melts the iron more rapidly than any cupola" that has ever been introduced, and each one of them will "produce a hotter and more fluid iron of uniform strength all through the heat" than can possibly be obtained from any other, and no matter which one is selected, we are told it will effect a saving in fuel of from 25 to 40 and even as high as 50 per cent over any other cupola that has been offered on the market. And so the Arabian Nights stories go on, followed by a lot of references and records of wonderful results obtained until the unsophisticated foundryman concludes, by the introduction of one of the cupolas, he will require little else than wind to melt his iron.

Foundry foremen have told me that the publishing of such phenomenal results in melting iron as occasionally appear in circulars and mechanical journals has injured them in the estimation of the firm who employed them. For instance, a superintendent who is not a practical foundryman, and therefore does not know that the most advantageous conditions must exist in cupola, blast, fuel, and iron to produce the best results, reads an account of high figures obtained in melting by some one who is ambitious to have his name attached to a performance that is to surpass all previous records. The superintendent does not stop to consider anything about the size of the cupola, or whether it is a 7,000 or a 70,000 pound heat, but he goes to the foreman of the foundry and points out the economy of melting at the figures contained in the account. Occasionally a foreman who has not the courage to stand up for what he knows to be right, and is afraid he will be considered incompetent, makes the coke weigh light and the iron weigh heavy in what he calls a trial heat, and presents a report that satisfies the superintendent, and another magical melting act goes on record.

During the past fifteen years the writer has traveled considerably, and while investigating this question has operated cupolas of various types from 18 in. to 72 in. inside diameter. I have in a plain 38 in. cupola, where everything was in right proportion and worked in harmony, melted 10 pounds of iron to one of fuel in a heat of 24,000 pounds, and the metal was fluid enough to run light castings clean and solid, but I do not pretend that these figures are a basis for any one else to work on, for I have then gone in a foundry where they had the most approved and improved type of cupola, and could not melt 7½ to 1 and call the iron melted if the fate of the nation depended on the result. I have never been able to reach the extraordinary high figures claimed by some men. My experience in actual practice has been on an average of 7 to 1, and in the exercise of strict economy it has often been less than that figure; much depends on the class of iron melted and the quality of work to be poured with the fluid iron.

I have frequently called at foundries where these monumental reports originate, in hopes I could see Aladdin with his wonderful lamp operating the cupola; but the days I called on the different foundrymen claiming to melt with such a low percentage of fuel there was always some reason why the lamp could not be rubbed up to its proper brilliancy to make the genii appear and produce the results published. If space allowed, I could tell some very amusing stories of how some of these reports are made up.

Mr. W. W. Snow, manager of the Ramapo Car Wheel Works, who I believe has had as much iron melted as any man in the United States, tells me that 7 to 7½ pounds of iron to one of fuel gives him better results than a higher ratio in producing good solid clean castings, even in large heats. From conversations and correspondence I have had with a large number of other prominent foundrymen, I select the following letters on this subject from gentlemen who are well known as contributors to the technical press:

From Thomas D. West, author of "American Foundry Practice and Moulder's Text-Book," Cleveland, Ohio:

"With reference to fuel and melting, I can only say that best of conditions must prevail, and the iron cannot be expected to successfully run light castings where 1 to 10 or less fuel is used in the cupolas now being generally used in the country.

"As for myself, I find no *economy* in trying to exceed 1 to 7½. To express what I mean by *economy* would fill many sheets, but my articles on this subject show the stand I take.

"It will not pay any foundry in the long run to try melting with lowest percentage of fuel possible. Any one could melt 1 to 10, and even higher, but the question is, what kind of liquid metal would be produced?"

From Geo. Vair, manager J. D. Murray Manufacturing Company Foundry, Wausau, Wisconsin:

"Our average result for good hot iron is 1 to 6, using Connellsville coke. We have no scrap at present, and our pig is heavy. I have melted at a higher ratio than this, but the castings would show cold shuts, therefore I consider it more economy for me to melt 1 to 6 or even less than above that figure.

"There are better cupolas than the one we are operating, especially for coke, from which better results may be obtained; but were it known, more cupolas would be found melting 1 to 5 than over 1 to 7, and it is an injustice to foundrymen to advertise such big results merely to gain reputation."

From David Spence, Supt. Foundry Geo. W. Brown & Co., Galesburg, Illinois:

"In regard to melting I could never do better than 1 to 7 and get good results. Where they claim such big things in melting there are always two piles of castings, the good and the bad, and it is hard to tell which is the largest. My experience has been with a plain shell, and in every case I have remodeled to suit myself with good results.

"Last May I was on a visit to New York. While there I took charge of a cast for a friend of mine. They use a —— patent cupola, but I could not get the big results claimed, such as 1 to 12 and 1 to 14. I should like to make a visit to one of these shops where they get such great results. I have had charge of foundries in Nova Scotia, Boston, Connecticut, and Illinois, and I have failed to find it only on paper."

From L. C. Jewett, Supt. Otis Bros. & Co., Yonkers, New York:

"The very best melting that I have ever done was 7⅛ to 1; that was in a good cupola with an excellent blast and excellent Lehigh coal, and in a heat of 18 tons, in Hartford, Conn. At present we are melting about 6⅛ to 1. The Wyoming Valley coal I am using is not as hard or durable as the Lehigh Valley, consequently have to replenish the bed oftener. Considering the quality of the fuel, I do not feel discouraged with the new cupola I recently put up. The following is the result of a heat:

Amount of iron melted	20,000 lb.
Amount of fuel consumed	3,100 "
Ratio of fuel to iron used	1 to 6·45

"It should be said, however, that *I melt iron*, and I claim good results cannot be obtained unless iron is melted hot. My ladles and cupola are in good condition when the heat is over, and bottom drops clean.

"With good Lehigh coal in a heat of 10 tons I feel sure I could reach 7⅛ to 1, but one thing certain: I will have the iron hot enough to look like white watered silk as it comes from the spout if it takes 4 to 1.

"Here is a heat at the rate of 8⅛ to 1:

Amount of iron melted	20,000 lb.
Amount of fuel consumed	2,400 "

"We have a cupola that lines to 46", air chamber all round with 12 tuyeres evenly distributed, tuyeres 15" from bottom plate, No. 6 Sturtevant fan running 2,800 revolutions, and I want to see some one take off a heat at the above figures with best anthracite coal and make a success of it. What I mean is, more castings will be lost for not running or poured short from the metal sticking to the ladles and thereby deceiving the moulders; the value of said loss would be greater than it would to have melted at the rate of 2 to 1 of coal.

"Let us analyze the two heats given at 1 to 8⅛. We have 700 pounds of coal saved over the figures in the first heat. Our coal costs us here $5.50 per gross ton; taking the 700 pounds we have saved at the spigot $1.72, and wasted at the bung by bad castings, badly bunged-up ladles and cupola, and, worst of all, bad temper from melters to core boy, well, say $10 in a ten ton heat; that is not extravagant to lose by cold shuts, etc., as the result of dull iron.

"I am not conceited, and when you find any one who can melt on an average at big figures, please send him to me, as I am anxious to learn how it is done."

We will not stop to consider heats of 25 to 100 tons, for they are the exception and not the rule, but will take them as they average in foundries throughout the country. I have before me about all the reports of cupola workings that have been published for several years past, and I find among them a number from men who claim, with cupolas of 35 in. to 40 in. inside diameter, and in heats of less than 18,000 pounds of iron, to be able to melt from twelve to over nineteen pounds of iron to one pound of fuel. For instance, the following figures look well on paper:

Amount of iron melted.	Amount of fuel consumed.	Ratio of fuel to iron used.
17,920 pounds.	1,232 pounds.	1 to 14·54 pounds.
9,800 "	635 "	1 " 15·43 "
8,800 "	530 "	1 " 16·60 "
10,700 "	610 "	1 " 17·54 "
13,100 "	680 "	1 " 19·26 "

Simply because I have not been able to reach these high figures, or see any one else do it, I do not say that it cannot be done. I try to be progressive, and am a thorough advocate of any improvement in machinery or advancement in mechanical work, but I am not going to try to compel any man who is in my employ as foundry foreman to produce results in melting iron that are beyond anything I have known to be accomplished.

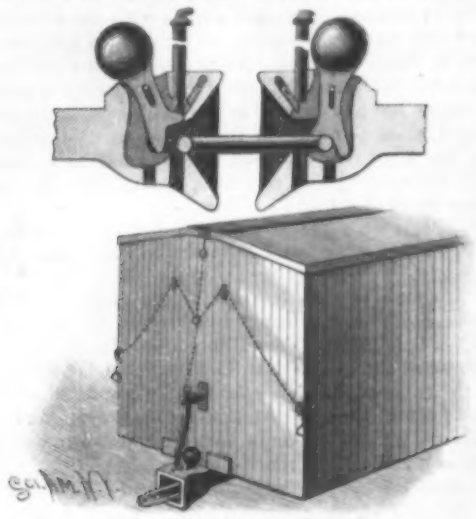
I would like to see some of these figures demonstrated, and I am now talking to the men who claim to produce them. I will present any man with $250 who will come to our works (Marshall, Texas) and melt 18,000 pounds of iron in a 38 in. cupola at a ratio of over fourteen pounds of iron to one of fuel, and have the metal fluid enough to produce good, clean, solid castings for locomotives, architectural work, and machinery. These figures will give the one who undertakes it the highest amount of iron to melt and the lowest ratio of iron to fuel given in the above table.

I will furnish as good, or better, cupola to melt in than can be found in the average foundry; good blast, first-class dry Connellsville coke, Scotch and American pig iron, and a regular run of car and locomotive cast scrap. All I ask is to do the weighing on the charging floor and keep the figures jointly with the man who is to accomplish it, and I will take pleasure in publishing the results.

WE have the greatest number of miles of railroad track of any country in the world, but the Argentine Republic can beat us and every one else for taking theirs straight. On the road from Buenos Ayres to the foot of the Andes is a stretch of 211 miles without a curve.

AN IMPROVED CAR COUPLING.

A car coupling which is simple in construction and designed to be very effective and automatic in operation is illustrated herewith, and has been patented by Mr.

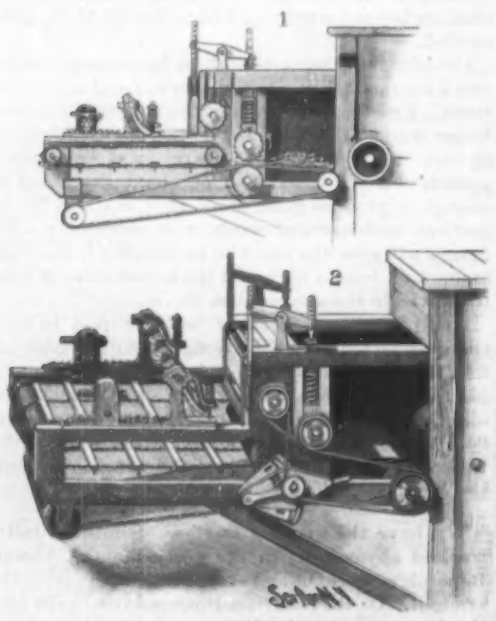


CHISHOLM'S CAR COUPLING.

John W. Chisholm, of Liverpool, N. S., Canada. In the front of the drawhead is a recess adapted to receive the coupling link, and in a vertical central rearward and upward extension of this recess is pivoted a dog with a weighted upper end, the dog having a slot, through which passes the pivot pin, secured in the drawhead. On the lower end of the dog are two noses or offsets, as shown in the small figures, one extending horizontally and adapted to support the coupling pin, and the other extending downward and adapted to be operated on by the coupling. The head of the coupling pin is pivotally connected with the lower end of an arm having a slot in its upper end, through which passes a pin secured in a bracket on the end of the car, operating chains extending from the upper end of the arm to the sides and top of the car. In the front end of the drawhead a key is held to slide in an inclined slot, the key having a slot through which passes a pin secured in the drawhead. The lower end of the key is adapted to pass into the coupling pin aperture to hold the coupling pin temporarily in position, as shown in the small figure to the right, when the dog stands vertically, and it is desired to cut out a car in a train of cars, the conductor raising the coupling pin and letting the key slide downward. The coupling pin is drawn to its uppermost position by one of the handles at either side or the top of the car, when the dog drops into the position shown in the small figure to the left, its nose supporting the pin, the link being held in horizontal position in the opposite drawhead by the nose of the dog resting on it, and the coupling being effected by the entrance of the link, which then pushes against the bottom offset of the dog, causing the latter to assume a vertical position and allowing the link to drop.

A BAND CUTTER AND FEEDER FOR THRASHING MACHINES.

An improved device for cutting the bands of sheaves and feeding the loose grain to the thrashing cylinder of a thrashing machine is illustrated herewith, and has been patented by Mr. Karl G. Bareis, of Livingston, Grant County, Wis. The thrashing machine cylinder has at one end a gear wheel meshing into a gear wheel

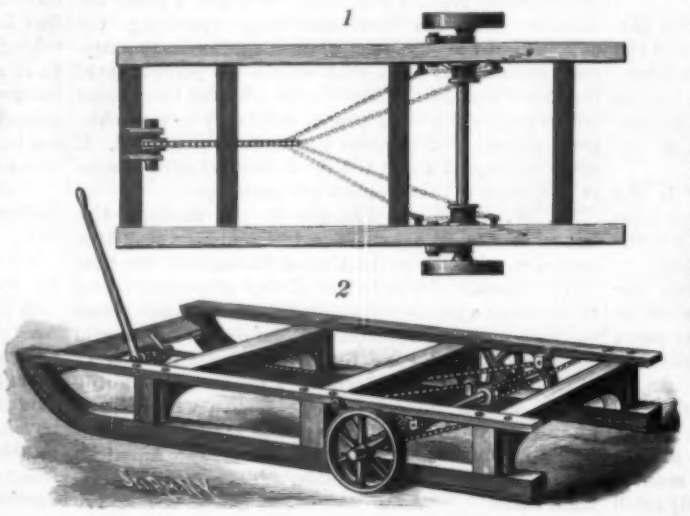


BAREIS' BAND CUTTER AND FEEDER.

attached to a shaft mounted in a frame carrying the feeding and cutting mechanism. Centrally on this shaft is a roller, over which, and over other loose rollers mounted in the frame, passes an endless belt, leading the loose grain to the thrashing cylinder. Above this belt, over one of the loose rollers, is a grooved feed roller, mounted in vertically sliding, adjustable, and spring-regulated bearings, the bearings being adjustably connected by a link and lever with a feed bar in front of another grooved feed roller, and below which is a roller over which passes an endless slat belt reaching to the front end of the frame, and there passing around another roller. The rotation of the thrashing machine imparts motion to the endless belt, the grooved feed rollers, and the slat belt, the two belts forming carriers for the grain to the machine, the grooved feed roller having the spring bearings rising and falling according to the amount of grain carried forward, while the link and lever connections of these bearings with the feed bar operate to prevent too much grain from passing to the machine. To a rock shaft extending across the frame above the slat belt knives are adjustably secured, being held in yielding position in relation to the slat belt, so that they will adjust themselves according to the amount of grain thereon. The side bearings of the rock shaft slide between guides on the side beams of the frame, so that the shaft can be readily moved toward and from the front end of the frame, and locked in position thereon, to suit bundles of different lengths. A belt-tightening device is provided to automatically take up any slack caused by the rising of the grooved feed roller and its pulley.

AN IMPROVED SLED.

A sled particularly adapted for transporting logs in places where bare patches of ground are frequent in otherwise snow-covered roads, or in crossing bridges,



WENZEL'S SLED.

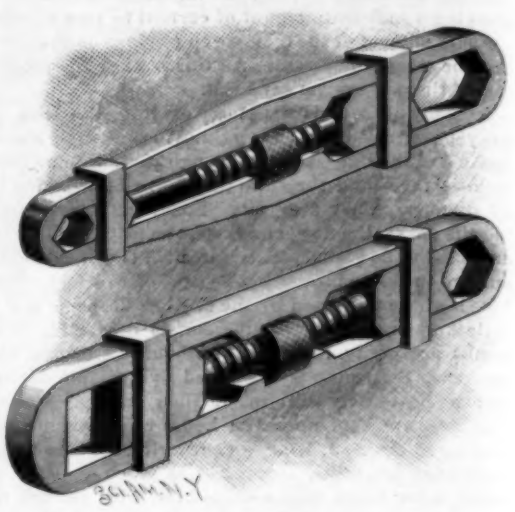
is illustrated herewith, and has been patented by Mr. Karl Wenzel, of No. 91 First Avenue, New York City. To the outer sides of the opposite side rails of the sled frame, nearer the rear than the front end, are pivoted the upper ends of arms having bearings at their lower ends, in which is mounted a transverse axle having wheels on its outer ends, whereby, when the arms are swung down, the rims of the wheels will be below the sled runners, and, the front end of the sled being raised by the draught strain, virtually its entire weight will be carried on the wheels. To adjust the wheel-carrying arms, ropes or chains are attached to the runners about in a vertical line with the top pivots of the arms, and carried rearwardly around double pulleys mounted on the axle, then around pulleys attached to the runners in front of the end fastenings, the forward ends of the two ropes being then attached to one end of a strong chain. This chain is carried forward around a sprocket wheel on the front end of the sled, then rearward, and its free end connected with two other ropes or chains which run rearwardly over pulleys attached to the opposite top rails behind the axle, thence forwardly around the double pulleys on the axle, and rearwardly again to a point of attachment farther back on the top rails. The sprocket wheel on the front end of the sled has reverse ratchet wheels and pawls, with a single removable ratchet lever having a handle by which the operator, while on the sled, may readily turn the sprocket wheel in either direction, to adjust and lock the wheels in position with their peripheries below the runners, or swing them rearward and upward to allow the runners to rest on the ground.

The Compass Finger Ring.

The old style of finger rings with a setting containing a small compass is now being brought into use by electrical engineers. Held near a line wire, the movement of the compass shows at once whether a current is passing.

AN IMPROVED WRENCH.

A wrench which can be conveniently used where nuts of different sizes and shapes have to be manipulated is illustrated herewith, and has been patented



WHITE'S WRENCH.

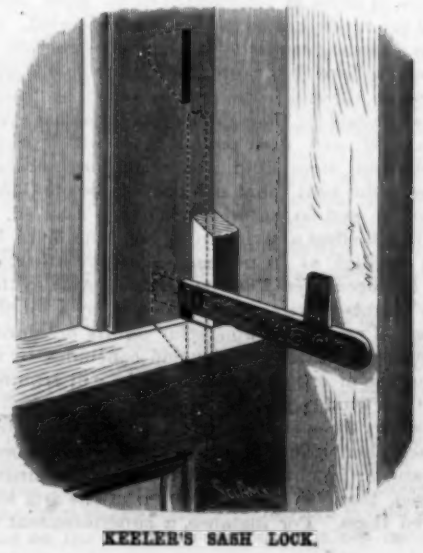
by Mr. Oscar C. White, of Wichita, Kansas. In making this wrench for ordinary shop use both sides are made parallel, one end being adapted for square and the other for hexagonal nuts. What may be styled a bicycle pattern is designed to have one end of the wrench smaller than the other, and both ends adapted for hexagonal nuts. Either end of the wrench serves as a handle for the jaw operating at the opposite end, the jaw desired for use being easily adjusted by means of the central thumb nut acting on the screw rod.

Painless Poultry Killing.

Mr. F. Baden Benger, the president of the British Pharmaceutical Conference, adopts and recommends the following plan for the "happy dispatch" of poultry. A large wide-mouthed stoppered bottle is kept charged with an ounce of chloroform. When a chicken has received sentence of death, it is held firmly under the left arm and its head slipped into the mouth of the bottle. A few deep inspirations follow, and the bird without a struggle becomes unconscious. Then, holding it by the legs, its neck is dislocated by a quick stretch. The plan is so simple that it might be generally adopted.

AN IMPROVED SASH LOCK.

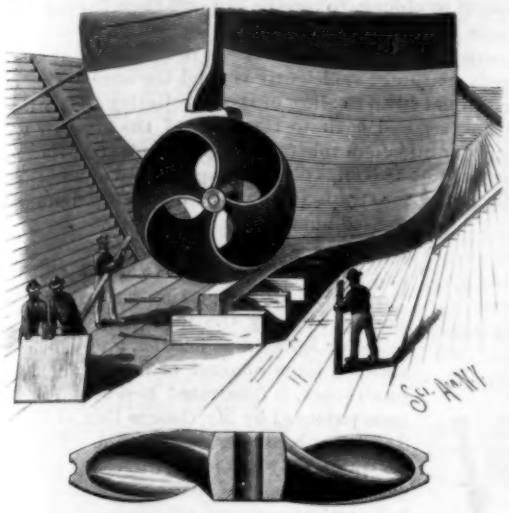
A simple sash lock, easy of operation, and which cannot be released from the outside of the window, even by a force greater than the sashes could withstand, is illustrated herewith, and has been patented by Mr. George W. Keeler, of Trenton, N. J. The upper sash is formed with one or more vertical recesses or mortises in the inner face of its side rail, parallel with the face of the parting strip between the two sashways, on which a vertically swinging bar is pivoted, the short arm of the bar being adapted to enter one of the recesses, when, to lock the sash, the long arm is swung downwardly across the top rail of the lower sash, and engaged by a stop secured to the window frame. The pivoted bar, when not in use, lies vertically against the face of the parting strip, as shown in dotted lines. The meeting rail of the lower sash is cut away to allow of its movement past the locking bar, and the upper sash may be lowered to a greater or less extent, and locked in the open position by locking the bar with its short arm in one or another of the vertical recesses in the side rail of the upper sash.



KEELER'S SASH LOCK.

AN IMPROVED SCREW PROPELLER.

A propeller wheel for water, wind, or steam, and adapted for use as a ventilator wheel, or for similar

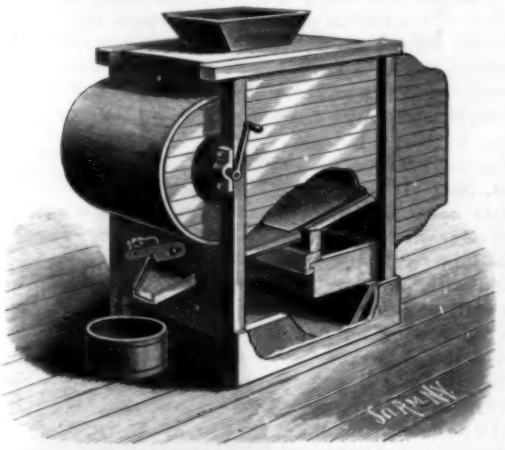


HODGEMAN'S SCREW PROPELLER.

purposes, has been patented by Mr. Henry D. Hodgeman, of Laramie City, Wyoming Territory, and is illustrated herewith, the small figure showing a central vertical section. The blades radiate in a diagonal line from the central hub, and turn as they approach the periphery to lie in a plane at right angles with the hub, being merged at their outer extremities into a peripheral band or ring, while being thickest at the point of intersection with the hub and thinnest at their intersection with the periphery. This arrangement affords a series of substantially circular openings between the hub and periphery, projecting diagonally through the wheel in a double curve, the blades presenting at the proper point an efficient bearing surface, while, owing to the peculiar curve of the apertures, the wheel may be made light and yet strong.

AN IMPROVED FANNING MILL.

An attachment for fanning mills by which the grain and chess are gathered in convenient receptacles, and



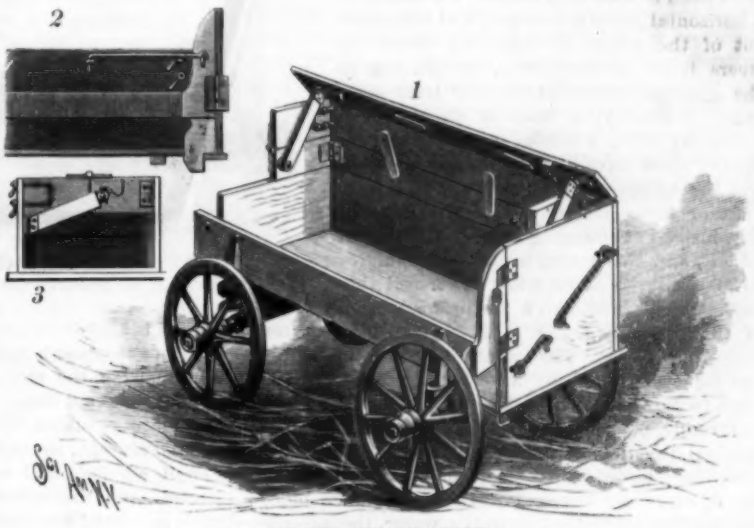
RISSER'S FANNING MILL.

thus prevented from falling on the floor, is illustrated herewith, and has been patented by Mr. John C. Risser, of Paris, Ill. The bottom of the mill is made into a receptacle with an inclined board on its rear end, for conveniently removing the chess, which only falls there when the chess box above is removed, for emptying or other purposes. The screen and the chess box are of any approved construction, but the screen, instead of discharging on the usual chute, discharges on a gathering chute having at its upper end a downwardly turned edge fitting over the upper edge of the usual chute. The gathering chute passes a short distance through the front board, and is provided on each side with upwardly extending flanges, which diverge from the bottom upward, so that the upper ends fit on the ends of the screen. A gate is held in the lower end of the gathering chute, pivoted at one end to the front board, the gate having an inclined bar on which is held to slide a weighted ring or collar. When the gate is swung upward, as shown in the illustration, the weight slides to the back end of the bar, and thus holds the gate open, the weight moving forward as the gate is closed, to hold the gate down, and prevent grain from passing out of the chute.

AN IMPROVED WAGON BODY.

A wagon body designed especially for farm use, wherein the boards of one side may be thrown up on the opposite side, so that articles may be conveniently thrown in as the crop is gathered in the field, and having an adjustable end gate, designed to form a platform to facilitate unloading, is illustrated herewith, and has been patented by Mr. Thomas Tyson, of Mound City, Mo. One side of the wagon body consists of three boards and the other side of two boards, the lower board of the latter side being of a height equal to that of the top and bottom opposite boards, and the upper board of a height equal to the central board of the opposite side, the lower sections of both sides being secured to the wagon body. The front end gate is made in two sections, the upper section being recessed from the center outward, a block being inserted in the recess, hinged at the upper end, whereby the block may be folded upward. The rear end gate is hinged to the bottom of the wagon body, and adapted to extend upward a distance above the sides, side strips being attached to the inner face of the end gate, which, when the end gate is closed, are adapted to extend without the sideboards. The end gate is retained in vertical position by hooks engaging eyes screwed in the outer face of the end gate, and an additional fastening is afforded by an eye in the cheek section, to which a hook is pivoted adapted to enter an eye in one of the sideboards. For gathering potatoes, corn, or such articles in a field, the wagon body is arranged as shown in the illustration, with the lowest side next the operator. When the wagon has been filled as high as the upper edge of the first sideboard, the intermediate section is brought over to its normal position, and the filling goes on, the upper board being finally brought over. If it is desired to have a low wagon body, one central section may be removed, with the upper section on the opposite side, the upper section of the front end gate being also removed.

To adapt this improved construction to an ordinary farm wagon, having two permanent sideboards of equal height, two additional hinged sideboards may be used on one side to equal the height of one additional sideboard on the other side, or two hinged boards of equal height may be used on each side.

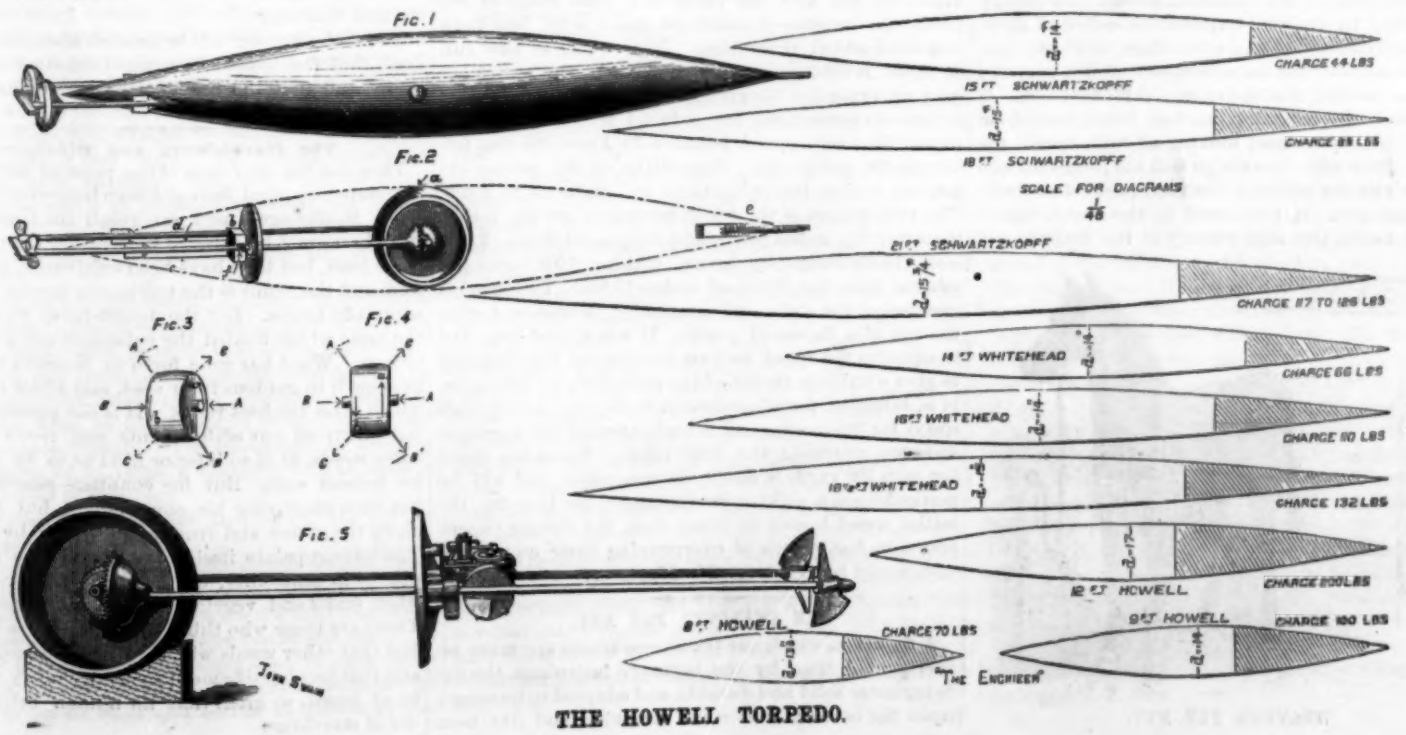


TYSON'S WAGON BODY.

THE HOWELL TORPEDO.

The Howell automobile torpedo is the invention of Captain Howell, United States Navy, whose patents thereon were first acquired by an American company formed for the purpose of developing the weapon. Motion is imparted to it by the momentum of a flywheel, set in rapid rotation before the torpedo is launched. On February 1, 1888, the Hotchkiss Ordnance Company, of London, purchased all of these patents, and have begun the manufacture of the torpedo in France and in the United States of America. The 8 foot Howell is 13·3 inches diameter, and carries an explosive charge of 70 pounds, the weight of its flywheel is 110 pounds, and the total weight of the torpedo is 325 pounds. Fig. 1 is a view of the torpedo, showing the firing pin; the axis of the flywheel, to which motion is given by means of a clutch and motor; the openings to the regulator chamber; the horizontal and two vertical rudders, and the tubes surrounding the twin screws. The shell is of brass. All other parts are of phosphor-bronze, except the flywheel and propeller shafts, which are of steel. Fig. 2 shows all the machinery in the torpedo, the shell and supporting rings being removed, and the outline of the shell indicated by dotted lines; *a* is the flywheel, to the axis of which are geared the two propeller shafts; *b* is the automatic immersion and steering regulator, which weighs 6½ pounds. It operates the tiller rod, *c*, connecting with the horizontal rudder, and two tiller rods, *d*, connected to the vertical steering rudders, power for this purpose being transmitted from the flywheel by a worm, *f*, on the propeller shaft and a gear wheel in the regulator.

The torpedo can be set to run at any depth from one yard to twelve yards. It is caused to stop at any desired distance on its range by an attachment to the propellers —not shown—and it rises to the surface, having a few pounds buoyancy. The torpedo can be made to sink at the end of its run, or float with the firing pin locked, as may be desired. Before launching, the firing pin is



THE HOWELL TORPEDO.

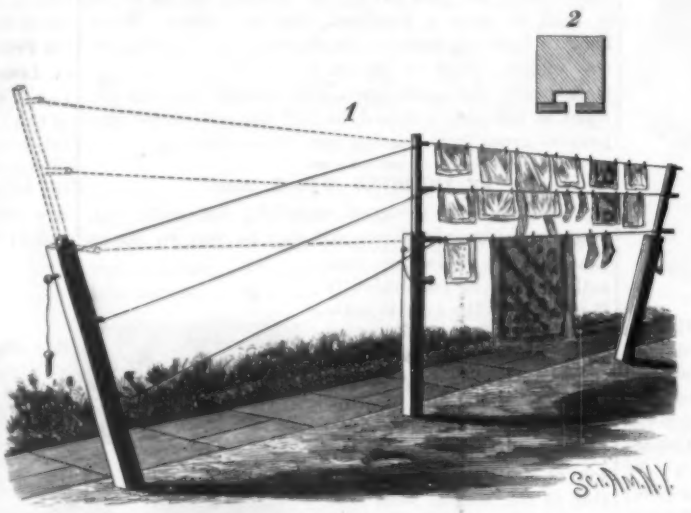
always locked, and will not act until the torpedo is clear of the vessel discharging it. The torpedo is always ready for practice, and requires no readjustment or preparation, except oiling the bearings after every second discharge. A depth register takes the place of the firing pin in practice shooting, and records an exact curve of the immersion during the run.

Any system of discharge may be employed which permits of a motion of the torpedo about its longitudinal axis, such motion being the gyroscopic resultant of a vessel's movements, or of pointing, and the energy of the flywheel. This is accomplished by allowing a slight rolling motion to the discharge tube, or to the torpedo support within it, which automatically returns to normal position when the motion ceases. The roll in these circumstances is small. If the torpedo be launched when rolled, the steering rudders at once operate to right it, without deflection.

The Howell torpedo, by its gyroscopic principle, is the only torpedo entirely automatic in maintaining its direction. It has no ballast, but, after launching, automatically takes the depth for which set, and directs itself in a vertical plane. Its course in a horizontal plane is straight, and independent of the action of deflecting forces. It steers itself automatically, though not in the generally accepted sense of boat steering. Ordinarily, a boat is steered on a course by using a rudder to return to such course when forced off it by any agency; but the torpedo when acted on by similar exterior forces, simply rolls to the right or left, instead of changing course to the right or left, and this rolling causes the regulator to give a series of impulses to vertical rudders, which produces a resultant motion of the torpedo opposite to that given by the exterior deflecting force. The result is that the torpedo, having been rolled by a deflecting force, is rolled back to normal position by the automatic action of the rudders, there having been no change in the original direction or course. This directive force was practically tested with a small 30 in. model having a 15 lb. flywheel, by a board of U. S. ordnance officers, who attempted to turn it in the water, the propellers being detached, and the wheel revolving 9,000 turns per minute, and they reported as follows:

"On taking hold of rear end of torpedo and pulling at right angles to length, it moved parallel to itself, rolling at the same time, but no deflection could be produced." This force is at its maximum at the moment of launching, when a torpedo is subjected to the strongest deflecting influences, and may be explained as follows to those who are not familiar with the principles of the gyroscope: Viewed from the right hand side of the torpedo, the wheel revolves, as shown by arrows, *a*, *b*—Figs. 3 and 4. A force acting on the point of the torpedo, tending to deflect it to the left, would act on the flywheel as a force at A and B tending to slue the latter; but the force at A acting on the particles moving in the direction, *a*, would have a resultant in the direction, A^1, and the force at B acting on the particles moving in the direction, *b*, would have a resultant, B^1; hence the torpedo can only roll to left instead of being deflected. The vertical rudders thereupon acting to turn the tail of the torpedo to the left and its point to the right produce a resultant, C, until the wheel—and torpedo—are rolled back to their normal vertical position, and without deflection from the torpedo's course. The amount of the roll depends upon the relation of the deflecting force to the energy of the wheel. In the 8 ft. torpedo the radius of gyration of the flywheel is 5·4 in.; therefore, at 10,000 revolutions per minute, the average speed of the particles is 470 ft. per second, and the energy is 167 foot tons. If the torpedo be discharged, point first, into a wave from the broadside of a vessel moving at high speed, the deflecting force will operate to roll the torpedo, and also move it in the yielding medium, parallel to itself, until submerged. If the speed of the vessel in this case be 30 knots, the side velocity of the torpedo will be $50\frac{7}{10}$ ft. per second when striking the water. Therefore, this deflecting force being insignificant compared with the flywheel energy, the resultant roll will be small. The directive force and propelling power are stored in a steel flywheel by giving it a high velocity of rotation, the source of power being external to the torpedo. The stored power is then transmitted directly from the flywheel to the propellers, and does not require to be worked off through an engine, as in other systems of propulsion. At 10,000 revolutions of its flywheel per minute, the energy in the 8 ft. torpedo is 375,000 foot pounds—167 foot tons; at 12,000 revolutions it is 550,000 foot pounds—245 foot tons; the elastic limit of the wheel is not reached under 14,500 turns per minute, when the stored energy would be 778,800 foot pounds—347 foot tons. The force is imparted by means of a motor actuated by either steam, electricity, compressed air, etc., as may be most convenient for the required service, and can be so imparted in thirty seconds, and thereafter sustained for any length of time, and until the instant of launching through tube or from a protected port. By taking a longer period to apply the force, as when preparing the vessel for action, or to charge upon the enemy, a motor of less power can be employed; in a small vessel the motor can be operated by stored force. It takes one minute to charge the 8 ft. torpedo with 375,000 foot pounds of energy, using a motor of 12 horse power, and five minutes for the same transmission of force with a motor of two horse power. After attaining 10,000 revolutions per minute, and detaching the motor, the flywheel of the 8 ft. torpedo, geared to its shafts and propellers, continues to revolve for one hour in the air.

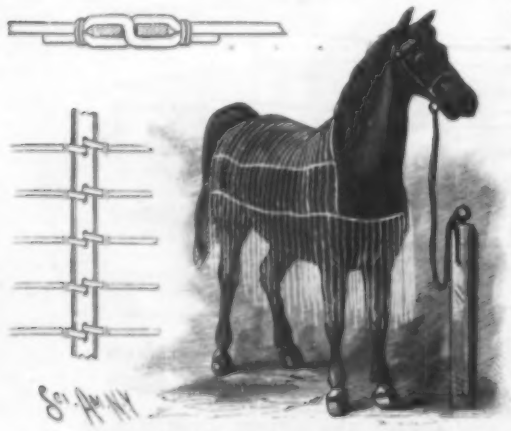
As the energy in the flywheel increases as the square of the revolutions, while the resistance to propulsion varies as the square of the velocity, the speed of the torpedo should increase in direct proportion to the number of revolutions made. It is found that the increase is in somewhat greater proportion with the higher speeds—speeds above 18 knots being more easily attainable in wholly submerged bodies. With the wheel spun to 6,400 revolutions—an energy of 150,470 foot pounds—the mean speed of the 8 foot torpedo is 18 knots for the first 200 yards of a total range of 500 yards. With 8,400 revolutions the mean speed is 24 knots for the first 200 yards of a total range of 800 yards—an increase of one-third speed with less than one-third added revolutions. This wheel is now run at 10,000 revolutions, and two-fifths of the entire energy are expended in giving relatively higher speeds before the revolutions are reduced to 8,400, when, as noted, the mean speed becomes 24 knots for the following 200 yards; and three-fifths of the energy expended before the revolutions are reduced to 6,400. The twin screws of the 8 foot torpedoes are $5\frac{3}{4}$ inches diameter, $7\frac{1}{2}$ inches pitch, and are geared down—3 to 5—to the flywheels by bevels, making 6,000 turns per minute when the flywheel makes 10,000. The speed is greatest at the start, and gradually decreases during the run of a thousand yards. It was at first intended to equalize the speed, and an attachment was designed to give a uniform thrust of the propellers for 600 yards. It is, however, found preferable to develop a very high speed for 300 yards, and a high average for a greater distance, retaining the long range. The mean speed for each 100 yards is easily determinable, and will be marked upon a sight. Furthermore, for bow fire, the initial speed is now so great that the danger experienced in fast vessels of overrunning their own torpedoes would be avoided.—*The Engineer.*



COX'S CLOTHES DRIER.

AN IMPROVED FLY NET.

A fly net in which the transverse straps are more securely held than by the ordinary fastenings, the net being more solid and durable, and adapted to lie snugly upon the horse, is illustrated herewith, and has been patented by Messrs. Vinton A. and Frank S. Weaver, of Moundsville, West Va. The longitudinal straps or bars of the net are made with perforations, either round or oblong, to receive through them the engaging ends of the transverse straps or lashes, arranged in pairs. The two transverse straps of each pair have their ends continued sufficiently beyond the edge of the longitudinal strap to allow of their projecting end portions being secured each to the body of the other by wire clips or other suitable fastenings. Each strap is thus secured by two clips or fastenings instead of one, thereby giving the straps a more solid hold, although no increased number of clips is used.



WEAVER'S FLY NET.

AN IMPROVED CLOTHES DRIER.

A device for supporting lines for drying clothes, whereby the lines may be readily raised or lowered as desired, and which will afford a large amount of drying room in a small space, is illustrated herewith, and has been patented by Mr. George Cox, of No. 123 South Sixth Street, Reading, Pa. The posts are preferably arranged three in a row, the two outer ones inclined away from the central vertical one, and all arranged adjacent to suitable walks. The posts are provided in one face with a guideway, as shown in section in Fig. 2, in which sliding bars are adapted to move up and down, the bars having pegs projecting through the slots to which the lines are secured. The pegs are of different lengths, so that the clothes on the upper lines may fall clear of those below. In hanging clothes, the sliding bars are all lowered, the bars being raised as the top lines are filled, and when all are hung the lines will be held straight, as shown in the dotted lines, the bars being held in their uppermost position by a pin inserted under them in each post. The incline of the end posts is such that the end of each line is raised practically in a line tangent to the arc of a circle struck from the center of its peg in the vertical bar, so that the line is kept nearly taut in any position, except when the vertical bar is down.

AN IMPROVED BRIDLE FOR BROOMS OR BRUSHES.

A simple and cheap bridle for effectually retaining a broom head in its proper place between the rows of broom corn is illustrated herewith, and has been patented by Mr. Robert E. Copson, of Omaha, Neb. It consists of a single piece of wire bent to form a loop, and with an upwardly projecting arm having an eye, the illustration showing the bridle open, closed, and as applied to the broom. In the eye is inserted a wire nail which is driven into the inner end of the handle. It is claimed that only one row of stitching will be needed when this bridle is used, that the broom corn can be worn down to the bridle, and that the broom will not get loose on the handle.

COPSON'S BROOM OR BRUSH BRIDLE.

The Huckleberry and Blueberry.

They are the only ones of the popular berries, says a contemporary, that have not been improved by cultivation. Middle-aged men can recall the time when the strawberry and blackberry were rather poor, commonplace fruit, but they have been cultivated, grown from seed, and the result is the toothsome berries which now adorn our tables. But the huckleberry we eat now is the same which tickled the palates of our great-grandfathers. Word has gone forth to improve this berry, to grow it in gardens from seed, and select the variety which gives the best result. It is not generally known, but nearly all our edible plants and fruits were originally weeds, or of so inferior kind as to be scarcely fit for human uses. But for countless generations man has been improving his environment, but more especially the grains and fruit upon which he now lives. The human palate itself must have been greatly improved in sensibility, owing to the difference between what fruits and vegetables were and what they are. There are those who think that this process is to go on, and that other weeds will be turned into useful plants, and that by scientific methods the quantity of food will be at length so great that no human being will ever die of starvation.

THE GREAT CHIMNEY AT THE CLARK THREAD WORKS, KEARNEY, N. J., HEIGHT 335 FEET.

We illustrate in this issue the great chimney recently erected at Kearney, near Newark, N. J., by the Clark Thread Co. It possesses the distinction of being the tallest chimney in America, and the fourth tallest in the world. It is the highest chimney ever built for boiler furnaces. The others that surpass it in altitude were erected for carrying off the products of chemical processes and for distributing the noxious gases produced.

The chimney stands in a quadrangle surrounded by the mill buildings of the new thread works and by the engine houses and present factory. It presents a most graceful appearance, and for the traveler passing through Newark, it forms an impressive feature of the scene. The ground on which it stands is on the eastern bank of the Passaic River, a rather low, flat area, so that the chimney bears somewhat the same relation to Newark that the Washington monument does to Washington. The latter structure is the only one in America that can dwarf it.

The shaft is circular and rises with a perfectly uniform batter from the bottom to the neck below the cap. Its diameter at the base is 28 feet 6 inches, and at the neck is 14 feet. This gives a batter of 7 feet 3 inches, or 2·85 inches for every ten feet. Its total height is 335 feet. Its internal diameter is 11 feet, giving one circular flue. At the summit it expands into a well proportioned capital surmounted by a cast iron coping. The latter weighs six tons, and is composed of thirty-two sections. They are bolted together by inside flanges, so as to present a smooth exterior.

The foundation is in concrete. The ground was excavated until a layer of firm gravel was reached, one foot below the water. Upon this the concrete was deposited. It was composed of crushed limestone 6 parts, sand 3 parts, and German Portland cement 1 part. It is 40 feet square and 5 feet deep, forming a block of 8,000 cubic feet volume, and weighing about one million pounds.

On this the base was started, composed, like the shaft proper, of brick laid in cement mortar. For this portion, up to four feet above the ground, a mixture of 1½ parts sand to 1 part German Portland cement was used for the mortar. The shaft up to a height of 160 feet is laid with the following mixture: Sand 6 parts, lime 2 parts, and cement 1 part. The sand and lime were made into mortar and had stood three months before use. This method of treatment is considered to improve the quality of mortar. Just before use the cement was added. From this point up the proportion of cement was increased until, at the top, the proportions became: Sand 3 parts, lime 1 part, and cement 1 part.

Two qualities of brick were used. The outer portions were of the first quality North River, and the backing up was of good quality New Jersey brick.

Every twenty feet in vertical measurement an iron ring, 4 in. wide and ¾ to ½ inch thick, placed edgewise, was built into the walls, about 8 inches from the outer circle.

As it starts from the base the chimney is double. The outer wall is 5 feet 2 inches in thickness, and inside of this is a second wall 20 inches thick and spaced off about 20 inches from main wall, and, of course, concentric with it. From the interior surface of the main wall eight buttresses are carried, nearly touching this inner or main flue wall, in order to keep it in line should it sag. The interior wall, starting with the thickness described, is gradually reduced until a height of about ninety feet is reached, when it is diminished to 8 inches. At 165 feet it ceases, and the rest of the chimney is without lining; no fire bricks are used in the lining.

As the chimney receives two horizontal flues placed diametrically opposite to each other, a 12 inch deflecting wall is built across the vertical shaft, starting from the base and rising 16 feet. The plane of this wall is perpendicular to the axis of the flues.

The two flues just alluded to are arched tunnels 7 feet wide and 8 feet high. An arched opening is formed for their entrance into the chimney, and a space of two inches is provided between the outside of the flue and the main structure. The walls of the horizontal flue as they enter the stack are 16 inches in thickness.

In these flues it is proposed to place feed water heaters for the boilers. About one thousand pipes will be included in them. It is believed that much more of the waste heat can thus be economized than is usual, as, owing to the great height of the chimney, a comparatively slight heat in the products of combustion will generate ample draught. The advantage, in an engineering sense, of so large a chimney will be derived from this factor of economy.

Twenty-one boilers of 200 H. P. each will depend upon the great chimney.

The general methods of construction adopted were characterized by simplicity as well as by efficiency. A steam elevator, with a platform 3 feet 6 inches by 3 feet, was arranged to run up and down inside the shaft. It had 3,000 lb. capacity, but never had to raise more than 800 lb. Two uprights, 4 × 6 inches, were braced against the inside walls and served as guides to the elevator. As the work progressed these and other fixtures of the elevator were carried up until finally the crane, carrying the main sheave, was above the coping nearly 340 feet from the earth. Interior scaffolds were built every few feet as the work progressed; two beams, 3 × 8 inches, being built into the walls to carry each one.

The greater part of the main shaft and lining was executed by eight bricklayers and five helpers. Their material was supplied from below by seven laborers on the ground. A system of bell and flag signals was arranged, so that no confusion could exist, and the men below could tell at once what material to send up in the elevator.

Two operations were needed to keep the chimney true. The circle had constantly to be verified or trained. By accurate plumbing a series of center points were carried up, one being established at every forty feet of height. From the line of those representing the axis of the shaft the training was done. The other operation was the plumbing. The batter or slope being a constant, a mason's plumb rule was planed off to give the true slope, and the sides were constantly tried with this. Both these operations were in charge of one man, who constantly was training or plumbing. By many hours of practice he acquired the art so perfectly that he never looked to the ground, his eye not ranging below the end of his rule.

Eventually the chimney was plumbed from a height of 300 feet, a forty-foot plumb bob being used. The deviation from the vertical was practically imperceptible.

The foundation, base, and 18 feet of the shaft were built in December, 1887. The work was then closed in for the winter. Operations were resumed in April, 1888, and continued when the weather permitted. The brick work was completed in September. Altogether 150 days of 9 hours each had been devoted to the construction—a remarkably short period for so great a work.

The total weight of the chimney is put at 5,000 tons, divided as follows:

Brickwork	9,051,899	lb.
Concrete	1,000,000	"
Ironwork	40,000	"
Total	10,091,899	lb.

The bearing surface is 1,600 square feet, giving about 2·8 gross tons per square foot, or more exactly 6,312 lb. The total number of bricks in the stack is 1,697,231; 201,000 were used in the base and foundation, and 66,277 in the caps.

No means are provided for ascending the chimney after the elevator is removed. Should it become necessary to do so, a balloon, with a line, can be sent up through the central flue and allowed to lose its gas and descend on the outside. This will provide means for drawing up a line of sufficient size to enable a man to ascend the shaft.

We append some dimensions of the three chimneys that exceed this one in height:

Townsend's Chimney, Glasgow, Scotland.

Height from ground to coping	454 feet.	
Outside diameter, at ground	32 "	
" " " top	13 "	4 inches.
Thickness of wall at base	5 "	7 "
Cost	£8,000.	

Tennant & Co.'s Chimney, Glasgow, Scotland.

Height from ground to coping	435 feet	6 inches.
Outside diameter, at ground	40 "	
" " " top	13 "	6 "

Dobson & Barlow's Chimney, Bolton, England.

Height from ground to coping	367 feet	6 inches.
Octagonal in section.		
Outside diameter, at base	33 "	10 "
" " " top	13 "	2 "
Cost	£3,000.	

Over three years were devoted to the building of the Townsend chimney. Tennant & Co.'s was built in one year.

The Clark chimney was erected by the company, under the superintendence of their foreman, Mr. Cunningham. It cost $30,000. From the point of view of architectural beauty, as well as perfection of structural features, too much credit cannot be awarded to all concerned in its erection. It is of interest to note that no workman was injured in any way during the progress of the work. A good idea of the general view of the surrounding country as seen from the top of the chimney may be had from the engraving at the right of the page. This represents the appearance of the chimney when the sketch was made, about two weeks ago, and it will be noticed that the iron hood shown in other views of the completed chimney had not yet been mounted in position. The chimney at this point is 20 feet in diameter, and the platform is so roomy that, in spite of the enormous height, an inexperienced visitor even is likely to experience no sense of giddiness, save, perhaps, from the slight swaying motion that is noticeable when the wind is blowing. The builders have allowed for about six inches of sway, which is about the amount of motion anticipated during a violent blow.

Correspondence.

Dangers of the Emery Wheel.

To the Editor of the Scientific American:

Noting the paragraph in your issue of September 15 regarding "Dangers of the Emery Wheel," we think you might do good service to your large circle of readers, many of whom doubtless use emery wheels, by calling attention to the facts of this case (or a supposed similar one), showing the dangers resulting from ignorance and recklessness. In this case, young Dunwald, who seems to have been more than usually intelligent, was trusted to buy his emery wheel, selecting the size he chose for the machine, put on one much too heavy, and running at a speed which subjected the wheel to a strain of more than twice that of the speed at which it was marked by the manufacturer as proper to be run, evidently not understanding that the "centrifugal strain increases as the square of the velocity." For this ignorance he has paid a severe penalty.

In an experience of some twenty years in the emery wheel business we have seen a great many instances of this kind; in fact, have never found but one or two instances of broken wheels that could not be traced directly to carelessness or misuse. Other causes besides too high speed are as follows: Forcing wheels on the arbor; too small flanges, which should be at least one-third of diameter of wheel; one flange smaller than the other, the large one being concave; neglecting to put an elastic washer between flanges; screwing up flanges too tight, thereby straining the wheel; allowing emery wheel to get out of true; the arbor running loose in the bearings; letting work get caught between the wheel and rest, etc.

The matter of speed is the most serious one, and we have been amazed at the reckless use in this respect. We often find parties running wheels at even double regular speed or four times regular strain. Our only wonder is that so few accidents happen. We would say that we think nearly all manufacturers test their wheels at least three times regular strain, and therefore consider themselves free from blame, and assume that the user is responsible for breaking. H. P. H.

Waltham, Mass., Sept. 15, 1888.

AN IMPROVED AUGER.

The auger illustrated herewith, which has been patented by Mr. Harry W. Richards, of Eden, Fla., has lateral cutters at the upper end of the spiral, and integral therewith, in the same vertical plane with the outer edge of the spiral. When a hole has been bored, the turning of the auger is continued, the cutters keeping clear of the hole until they come to the rough edge at the bottom of the hole, where a single turn causes the cutters to clean the rough edge.

Old Wooden Water Pipes.

At a recent meeting of the Newcastle Society of Antiquaries, one of the members presented some pieces of wooden pipes that were recently discovered in the Side, while some new telephone lines were being laid. They were made of elm, and illustrated two methods of joining pipes. There was, in one method, a butt joint, which was made water tight by an iron ferrule. There was also the spigot and faucet principle, a pointed end fitting into a cup-shaped socket, fastened with a pin. It was mentioned at the meeting that in 1698 an act was obtained to supply the town with water, and four-inch pipes were put down from the Town Moor and across to Gateshead. It was believed by some that these were part of the water pipes used.

A Railroad Racing Dog.

James Griffin, of Danbury, Conn., has a small terrier dog that is surprising the people of his town by his abilities as a runner. Every evening during the summer, when the 6:45 train from the West blew its whistle a few rods from the Main Street crossing, the dog would bound out of the house near by and take the track ahead of the train for the station, half a mile away. The train crosses Main Street at the rate of fifteen miles an hour, and between the crossing and the station is a trestle about 300 feet long. Over this the dog flies, always keeping just so far ahead of the train, slackening his speed as the air brakes are applied, and coming into the station at the same distance ahead of the train as he took when he started the race. Once or twice the engineer has put on steam to try and overtake the dog, but he has not yet succeeded in doing it. The dog never looks back, never barks, and never pays any attention to the calls of his master. When he reaches the station he looks up at the engineer, gives two or three short yelps, and quietly trots home up the track. This performance is repeated with unfailing regularity, and if an effort is made to keep him in the house at train time, he raises an unearthly yelping. It is the custom now for crowds to gather to see the exhibition racing.—*N. Y. Sun.*

MOUGIN'S "FORT OF THE FUTURE."

In the domain of the art of war a new fact has recently become known, which is of a nature to carry with it consequences of great importance—a new fact, we say, but not an unlooked-for one. A problem which was long regarded as insoluble has finally been solved. Artillery, the progress of which is continuous, has found a method of firing, without danger of premature explosion, hollow projectiles charged with breaking explosive substances. It must be admitted that this discovery is of a nature to modify the art of war profoundly. A revolution is announced, which, considered from the standpoint of the extent of the results, may be compared to that which occurred on the occasion of the invention of gunpowder. The firing of a melinite or gun-cotton shell is capable of producing singularly powerful effects, the verification of which has already upset the principles of the art of constructing permanent fortifications.

Instructed by the first experiments to which he has recently been led, the military engineer is unable to disguise the fact that, without the concomitance of great expense, it is no longer possible for him to construct walls capable of resisting the power of these new methods of attack. At the same time, he has found himself constrained and forced to suppress within his works those military structures hitherto called bomb-proof, because they consisted of a series of connnected vaults, generally of 19 feet span, and 3 feet thickness at the key, and covered with a mass of earth from 9 to 13 feet in depth. Such structures, by the force of things, have become singularly vulnerable and easily destructible even. The military engineer can therefore no longer derive any material advantage from the masonry that has hitherto been the principal element of his structures; but, can he still count upon the properties of masses of earth properly arranged? No; earthworks cannot withstand the fire of projectiles filled with a breaking charge. Under the action of the bursting of the shell, the earth shoots up into the air, disperses in powder, and finally disappears. And, more than this, acting after the manner of a tamping, the mass of earth converts the projectiles that have entered it into dry torpedoes, and hence it is more injurious than useful. As the engineer can bring into play neither earth nor masonry, what resource remains to him?

It has been many times observed that progress makes its way in a quasi-circular path. The human mind, in pursuing the end that is assigned to it, merely describes cycles always passing through the same points. An idea is suggested to it, it grasps it, then repudiates, and then again returns to it, so that, in the course of ages, extreme civilization often nearly touches extreme barbarism. Fortification offers us a striking example of this mode of evolution in a circle.

In the times of the great historic alluviums, quaternary man, as we know, dwelt in caves. Some of these places of refuge could contain two or three hundred persons; but, although the interior was roomy, the entrance was narrow. In time of peace, this exit was closed by means of a curtain made of reindeer's skin, while in time of war a number of rocks, properly piled, performed the functions of a defensive door, and the joints formed embrasures through which the inclosed people shot out their projectiles. The quaternary cavern was therefore nothing else than a fortress.

Well, in our own day, in the last years of the nineteenth century, we are about to see the military engineer return to the idea of the defensive cavern. In the number of prehistoric fortifications, science admits those strange structures that have been discovered in France, Germany, and Scotland, and that have received the name of vitrified forts. These inclosures, situated upon ancient formations, crystalline or otherwise, are formed of various materials, granite, gneiss, quartzite, basalt, etc., fused together by means of fire.

Well, in our day, the military engineer recommends,

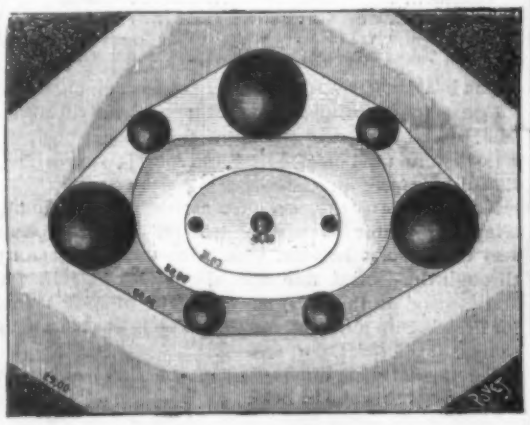


Fig. 1.—BIRD'S EYE VIEW OF THE PLAN OF THE SUBTERRANEAN FORT.

not the vitrified rockwork, which he knows not how to make, but beton, which is analogous to it.

In historic times, during the long period styled antiquity, fortified inclosures had a profile of considerable dimensions. The obstacle consisted of a wall which was no less than from 60 to 95 feet in thickness. The scarps of Nineveh, for example, and those of Babylon, were more than 85 feet. Why did ancient engineers adopt such dimensions, which now appear to us so huge? Because it was necessary to oppose a great resistance to the action of demolishing apparatus, especially to that of the battering ram.

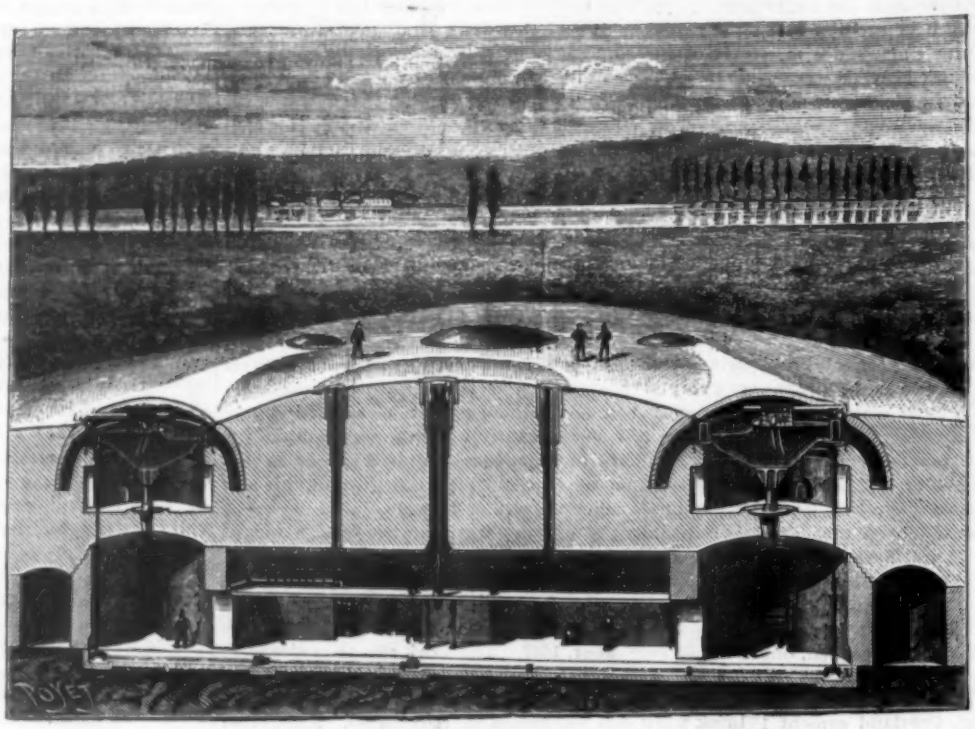


Fig. 2.—PLAN OF THE FRONT OF THE FORT.

Well, in our day, the military engineer who is embarrassed by the firing of shells containing a breaking charge would have to have recourse to such thicknesses. If he does not decide to do so, one of the reasons is that the marvels of modern industry permit him to substitute for masonry masses of metal having the same resistance with less thickness.

Then it has been found that beton and a metallic cuirass alone resist the action of shells containing a breaking charge—such as melinite or gun-cotton. Hence it follows that these two elements of construction should be able to suffice the engineer. That being the case, it is evident that the forts that it is necessary to construct cannot any more resemble those that now constitute the defenses of our frontiers than the latter resemble the strong castles of the middle ages.

The neo-modern fort, conformable to the type devised by Commander Mougin (*attache* to the General Direction of the Forges of St. Chamond), the construction of which upon a certain position selected near our frontier has been ordered by a ministerial decision of July 23, 1887, has a singularly original character.

Let one imagine to himself a bulging of the earth, recalling on a large scale one of those hillocks produced by the subterranean work of the mole. We have not here, however, a mass of earth, but rather a block of beton. This artificial rock, measuring fifty yards in length by from thirty to forty in width, rises from a dozen yards beneath the natural ground. Its maximum projection above the earth does not exceed three or four yards. Externally, then, it exhibits the aspect of an ellipsoidal calotte gently sloping to the earth and nearly invisible to the eye of an observer, provided that it has for a base the bottom of a depression in the ground (Fig. 1).

At the center of this rock rise, flush with the surface, three armor-clad turrets established *en coin*—one and two—each armed with two guns of large caliber; at the circumference, four small disappearing turrets, each armed with rapid-firing guns; and at three other properly selected points, armor-clad observatories. Of these latter, one permits of watching the ground of attack, and the two others are designed for projecting fascicles of electric light at night, and thus illuminating the dangerous points of the territory. Each of these turrets and observatories closes a cylindrical well having cuirassed sides, and debouching at the base in a system of subterranean apartments (Fig. 2). These latter are arranged in part as storerooms for provisions and ammunition and in part as machinery rooms. The underground machinery department includes a powerful steam engine, with cistern and duplicate boiler, a battery of ventilators for renewing the air, accumulators with pumps, and hydraulic motors for raising, lowering, and revolving the turrets and elevating the ammunition, etc., and, finally, dynamos and electric accumulators for internal lighting and projecting light externally (Fig. 3).

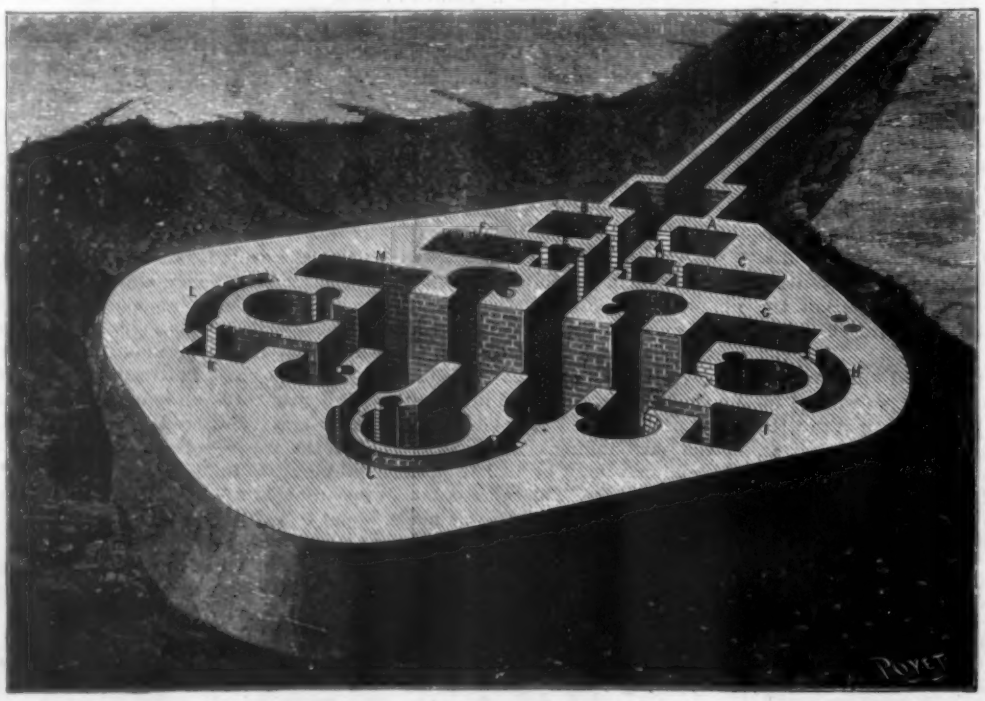


Fig. 3.—PLAN OF THE FOUNDATIONS.

A. Infirmary. B. Quarters of lieutenant commander and surgeon. C. Projectile magazine. D. Room for charging projectiles. E. Cartridge factory. F. Powder magazine. G. Generators and kitchen. H. Coal room. I. Office of the commander and telegrapher. J. Room for spare stores. K. Office of accountant. L. Provision room. M. Accumulator.

How is this cave entered? Communication with the exterior is had through a tunnel, whose top is eight or ten yards beneath the natural level of the earth. This gallery, the length of which necessarily varies with local conditions, branches and

runs, on the one hand, to the apartments above mentioned, and on the other to the bottom of a cuirassed well. A winding metallic stairway runs along the sides of this well, but is not attached thereto. This well, with sufficient opening to allow of the passage of duplicate *materiel*, forms an integral part of an iron plate framework, capped by a horizontal plate 8 inches in thickness. This plate, which normally closes the mouth of the well, is protected by the cross fire of the two disappearing turrets.

If it is desired to give access to the fort, it is only necessary to cause a hydraulic piston to act through a simple maneuver of a cock, and thus raise the internal framework, the staircase, and the plate 6½ feet. All forwarding of material and every relief of the garrison is signaled by telegraph or telephone. The doorkeeper does not maneuver the hydraulic elevator until he has heard the password and the disappearing turret on guard has recognized the comers. Moreover, there are arranged along the tunnel a number of obstructions analogous to those that the engineers of the middle ages used to multiply in the galleries giving access to their fortified castles. Finally, the entrance to the catacombs is itself provided with a door, defended by two mitrailleuses.

The garrison is reduced to thirty or forty mechanicians and specialists having in charge the manipulation of all the machinery above noted. The situation of this *personnel* is not without analogy with that of the mechanicians and stokers of armor-clad ships, who also are only able to breathe through the artificial ventilation provided. These men, however, can be very frequently relieved.

Commander Mougin's fort, as just described, with its three large two-gun cuirassed turrets, its four small turrets with two rapid-firing guns, its three obstructions, and all its internal machinery, will not exceed in cost the net sum of $500,000. This is relatively cheap.

Upon the whole, the conception of the fort of the future presented itself long ago to the mind of professionals in the form of a relatively invulnerable armor-clad ship run aground on the position commanding the defile or railway to be defended. Commander Mougin has certainly done a useful service in showing how such a conception can be carried out.

His solution of the problem offers the advantage that, with equal live power, that is power in artillery, it permits of reducing, in the ratio of ten to one, the effective *personnel* necessary to perform the service. All our generals deplore the fact that, in the present system, the constitution of the regular garrisons absorbs, at the hour of mobilization, several hundred men, who might keep in the field, and the presence of whom on the field of battle would be of a nature to lead to decisive results. In this new system, the absence of a few mechanicians and assistants, taken from the ranks, will not perceptibly reduce the territorial regiments that are called upon to furnish them.—*La Nature.*

The Gas Meter Specter.

F. H. Carruth, on the joys of what he terms suburban life, is not confined to any locality, but his well told experience with the gas man illustrates the belief many gas users cherish:

Every other day a man comes from the gas works, and after we let him in he goes down to the foot of the basement stairs and holds a secret conference with the meter. He opens a little door in it and takes a poker and stirs it up inside. Sometimes during the executive session we overhear him sort of growling away to himself, and complaining about the way the meter acts. He will explain to it that it isn't doing as well as Brown's, and that Robinson's is 'way ahead of it. Then he will punch it again with the poker, and we can hear the wheels buzzing around in it. He says meters are like other folks, liable to shirk and to 'tend to business. Then he will hit it another whack, and ask it pointedly if it wants to bankrupt the company. When he gets it running with a low, steady hum, he will shut the door and take down some figures in a blankbook, and as he comes up the stairs we will hear him saying: "Three and four and one are eleven and five is eighteen, and seven is twenty-nine, and six is forty-one, and four to carry is fifty." Then he will go around and look at our burners and dig away at them with a screwdriver and an old jackknife, and will try to sell us some new jet tips which look like old-fashioned open-top thimbles. He said one day that the superintendent told him that the company wasn't making nothing. I asked him how the stock was selling, and he said that he understood there wasn't any on the market just at present. He thought it had been withdrawn to be watered or something like that. Probably they would be awful glad to get rid of it after that.

A PREHISTORIC BEAR.

Large quantities of the bones of various animals, such as the lion, hyena, bear, and prehistoric dog, have been found from time to time in caves in various parts of the world. It is probable that, as far as Europe is concerned, these caverns were more abundantly filled a few centuries ago than at present. In the prescientific era of medicine, a brisk traffic took place in these prehistoric bone deposits, as in the analogous case of Egyptian mummies. A physician of Gratz, Styria, writing in the year 1695, describes how he received many hundreds of bones and teeth, as well as four dragons' heads, and that, with these potent implements, he achieved numerous noteworthy cures. It has since been ascertained that these skulls and bones belonged to bears. The receptacle where they were found is still called "Dragons' Cave."

Our illustration represents the skeleton of a prehistoric bear (*Ursus spelæus*), as well as a second gigantic skull, which were found about four years ago in the Peggau Cave, near Gratz, Styria. The entrance to the cave is in a perpendicular rock face, some hundreds of yards in height, and the animal remains were covered with a stalactite deposit from five to ten inches thick, which had effectually preserved them from decay. Under the stalactite was a conglomerate several yards in thickness, composed of calcareous spar, quartz, and limestone. Several days were occupied in chiseling the bones out of this solid mass. A hole was made in the hinder part of the lower skull represented in our illustration, for the purpose of examining the interior. Its blunt and colossal shape differs considerably from the modern type, and indicates that this bear belonged to a very early period. The skull of an ordinary cat is given underneath in order to show the comparative size. The skull of the bear is wonderfully well preserved, the teeth are firm, and the bones bright yellow. To look at they might have been under the earth some dozen years, instead of at least twenty or twenty-five thousand. This skull is about twenty inches long and twelve inches high. The tusks are about four inches long. The skull of the skeleton is rather longer, but not quite so high. The entire skeleton is over nine feet high. The living animal was probably over ten feet.—*The Graphic.*

A PREHISTORIC BEAR.

THE amount in the U. S. Treasury to the credit of the Patent Office fund is $3,500,000, a sum ample, one would think, to enable the Patent Office to employ a sufficient force to keep the work of the office so well up that but little delay should occur in disposing of every application for a patent, but unfortunately some of the classes are very much in arrear with their work.

The Effects Produced by Earthquakes upon the Lower Animals.

In the last issue of the "Transactions of the Seismological Society of Japan," Professor Milne, the well-known student of volcanic phenomena, discusses the effects of earthquakes on animals. The records of most great earthquakes refer to the consternation of dogs, horses, cattle, and other domestic animals. Fish also are frequently affected. In the London earthquake of 1749, roach and other fish in a canal showed evident signs of confusion and fright; and sometimes after an earthquake fish rise to the surface dead and dying.

During the Tokio earthquake of 1880, cats inside a house ran about trying to escape, foxes barked, and horses tried to kick down the boards confining them to their stables. There can, therefore, be no doubt that animals know something unusual and terrifying is taking place. More interesting than these are the observations showing that animals are agitated just before an earthquake. Ponies have been known to prance about their stalls, pheasants to scream, and frogs to cease croaking suddenly a little time before a shock, as if aware of its coming. The Japanese say that moles show their agitation by burrowing. Geese, pigs, and dogs appear more sensitive in this respect than other animals. After the great Calabrian earthquake it is said that the neighing of a horse, the braying of an ass, or the cackle of a goose was sufficient to cause the inhabitants to fly from their houses in expectation of a shock.

Many birds are said to show their uneasiness before an earthquake by hiding their heads under their wings and behaving in an unusual manner. At the time of the Calabrian shock, little fish like sand eels (*cirricelli*), which are usually buried in the sand, came to the top and were caught in multitudes. In South America certain quadrupeds, such as dogs, cats, and jerboas, are believed by the people to give warning of coming danger by their restlessness; sometimes immense flocks of sea birds fly inland before an earthquake, as if alarmed by the commencement of some sub-oceanic disturbance. Before the shock of 1885 in Chili, all the dogs are said to have escaped from the city of Talcahuano.

The explanation offered by Professor Milne of this apparent prescience is that some animals are sensitive to the small tremors which precede nearly all earthquakes. He has himself felt them some seconds before the actual earthquake came. The alarm of intelligent animals would then be the result of their own experience, which has taught them that small tremors are premonitory of movements more alarming. Signs of alarm days before an earthquake are probably accidental; but sometimes in volcanic districts gases have emanated from the ground prior to earthquakes and have poisoned animals. In one case large numbers of fish were killed in this way in the Tiber, and at Follonica on the morning of April 6, 1874, "the streets and roads were covered with dead rats and mice. In fact, it seemed as if it had rained rats. The only explanation of the phenomena was that these animals had been destroyed by emanations of carbon dioxide."

Pelicans Flying South.

Residents in the north part of the city were treated early one morning recently to a rare and interesting spectacle in the flight south of a large flock of pelicans. There were several hundred of the great birds, divided into two sections. They were quite low, and the pouch under the lower bill and throat of each could be plainly seen. The first section was over one hundred in number, flying slowly in an almost unbroken single line, and crossing the river to the Illinois side just above the upper ferry. The second division came along immediately after, but instead of at once making passage over the Mississippi, began circling, as though at a loss which way to proceed. This movement was continued fully ten minutes, when a leader suddenly started in a bee line for the southeast, the rest trailing after and soon getting out of sight.

It was said by persons familiar with the bird that it was the American white or rough billed pelican, weighing when full grown about 18 pounds. The bill is 14 inches long, and the pouch is some 7 inches deep at the widest part. During the winter the species is found along the Florida and Southern coast, but in the summer goes to the interior of the fur countries at the North, where it breeds. It was claimed the going to the South at this time presaged early cold weather.—*St. Louis Globe-Democrat.*

Sir John Lubbock on the Customs of Savage Races.

The Saturday evening, or popular, lecture to the working classes given during the recent meeting of the British Association was delivered by Sir John Lubbock, who took for his subject the "Customs of Savage Races."

After intimating that the primitive condition of man was one of savagery, and that the history of the human race on the whole had been one of progress, Sir John Lubbock said: It seems from the study of modern savages that we can gain a fairly correct idea of man as he existed in ancient times, and of the stages through which our civilization has been evolved. At the same time the study is by no means easy, because many things which seem natural and obvious to a savage appear to us absurd and inconsequential. Moreover, if we often find it far from easy to understand savages, they naturally have much greater difficulty in understanding us. All over the world nations on first seeing white men have taken them for ghosts or spirits. Our weapons, tools, animals, in fact, all our belongings, are at first a source of great wonder. An Australian tribe, for instance, when they first saw a wagon drawn by oxen, were much puzzled as to what the oxen could be. It afterward appeared that some thought they were spirits because they had spears on their heads, while others maintained that they were the wives of the white men, because they carried the burdens, which among Australians is the special duty of women. Again, the modes of salutation among savages are sometimes very curious, and their modes of showing their feelings quite unlike ours. Kissing seems to us so natural an expression of affection that we should expect to find it all over the world, yet it is unknown to the Australians, the New Zealanders, the Papuans, and the Esquimaux and other races. I mentioned this fact about the negroes in one of my books many years ago, never supposing that it would give any offense, and was surprised to receive a most violent anonymous letter from a negro of St. Domingo on the subject. He abused me in unmeasured terms, and ended by saying that he would like to drink my heart's blood.

The Polynesians and the Malays always sit down when speaking to a superior; in some parts of Central Africa it is considered respectful to turn the back to a superior. Captain Cook asserts that the inhabitants of Maliedo, an island in the Pacific Ocean, show their admiration by hissing; the Todas of the Neilgherry hills in India are said to show respect by raising the open right hand to the brow, resting the thumb on the nose; it is asserted that among the Esquimaux it is customary to pull a person's nose as a compliment; a Chinaman puts on his hat where he should take it off, and among the same curious people a coffin is regarded as a neat and appropriate present for an aged person, especially if in bad health.

Among the Yombas of West Africa, who take great care of their teeth and scrub them well at least three times a day, an old tooth brush is regarded as a touching present, not being so much intended for actual use indeed, but rather as conveying a sort of implied message that as the sender took the greatest care of his teeth and used his tooth brush continually, so his friend was also in his thoughts morning, noon, and night.

Mr. Taplin, a missionary to whom we are indebted for an excellent account of the natives of Australia, tells a curious story against himself. "When," he says, "I asked the word for sin, they gave me the one for 'thin,' and so I was led into representing that it was hateful to God for men to be thin; that they would be condemned for it. So they came to the conclusion that it was pleasing to God for people to be fat. In fact, I had been telling them that all lean people went to hell, and fat people to heaven."

Some ideas, indeed, which appear to us inexplicable and fantastic are very widely distributed. For instance, medicine; our system seems so natural; send for a doctor, get prescription, pay him, take medicine. By no means. 1. Sorcerer: evil spirits, noise. 2. Wizard: charm on board. 3. Doctor: drinks his own medicine. 4. China: pay while well.

In many parts of the world a man is strictly forbidden to speak to his mother-in-law. Again, probably every Englishman who had not studied other races would be astonished to meet with a nation in which, on the birth of a baby, the father, and not the mother, was put to bed and nursed; yet though this custom seems so ludicrous to us, it prevails very widely. In some parts of Australia, when a man marries, each of the bride's relations gives him a good blow with a stout stick, by way, I suppose, of a warm welcome into the family.

Among the Kalmucks of Central Asia, again, the marriage ceremony is very romantic. The girl is put on a horse and rides at full speed. When she has got a fair start, the lover sets off in pursuit; if he catches her she becomes his wife, but if he cannot overtake her the match is broken off, and we are assured, which I can well believe, that a Kalmuck girl is very seldom caught against her will.

This idea of capture in marriage occurs almost all over the world. Hence no doubt the custom of lifting the bride over the doorstep, which occurs, or did occur, among the Romans, the Redskins of Canada, the Chinese, the Abyssinians, and other races. Hence also perhaps our custom of the honeymoon, and hence, may be, after a wedding things are thrown, as McLellan has suggested, in mock anger after the departing bride and bridegroom.

It is remarkable how persistent are all customs and ceremonies connected with marriage. Thus our bride cake, which so invariably accompanies a wedding, may be traced back to the old Roman form of marriage by *confarreatio*, or eating together, and is found also in other parts of the world, as, for instance, among the Iroquois of North America. It must, we know, be cut by the bride, because it is the duty of the wife to prepare food for her husband. It has always seemed to me that one of the clearest proofs of the low mental power of savage men is that afforded by arithmetic. For instance, in no single Australian language is there any word for "five." They said, "One, two, two, one, two, two, many." The fingers are greatly used as a help in these simple calculations, and all over the world we find the word "hand" standing for "five" in reference to our five fingers; indeed, if we had had six we should probably have had a duodecimal notation, which would have been in many respects a great improvement on our present system. Even our own word "five" is a case in point, though it is so much worn by use that its original form is almost unrecognizable.

The original Indo-European word for "hand" is found little altered in the Persian *penze*. In Greek *penze* becomes *pente*, in German *funf*, whence our "five." The Punjab is the country of "five rivers," from *penge*, "five," and *ab*, "water," a root which we find again in many Celtic names, as, for instance, in Aberdeen, Aberystwith.

Carver astonished the Canadian Indians by allowing them to open a book wherever they pleased, and then telling them how many pages they were from the beginning. The only way they could account for this was by concluding that the book was alive, and told him whatever he asked.

We know that among many races, when a man died, his wives and slaves, sometimes, also, his horse and dog, were killed and buried with him, in order that their spirits might accompany him to the other world. But the preparation for eternity did not end here. Just as the survivors killed the wife and slaves, so they also "killed" his arms and implements, his clothes and ornaments, so that their spirits also might go with their master, and he might enter the other world as a great chief should.

The Red Indian, Mr. Sproat tells us, quite understands that the things themselves remain in the grave, but believes that the phantoms of the things accompany the spirit of the dead. Even among the Greeks we know that a coin was put in the mouth of the dead in order that he might have the wherewithal to pay the ferryman, Charon; and the Chinese are said to burn paper money with the dead—a process much to be commended from a banking point of view.

Our own sovereigns are still crowned on a stone, the Lia Fail or Stone of Destiny, which is said to have been the pillow on which the patriarch Jacob slept at Bethel when he saw "the ladder set up on the earth, and the top of it reached to heaven, and behold the angels ascending and descending on it." It was carried to Ireland, then to Iona, subsequently to Scone, and brought to England by Edward I., though some Irish antiquaries maintain that the true Lia Fail is the upright stone which stands on the hill of Tara.

We all remember the significance attached by Joseph's parents and brethren to his dreams, as well as the political importance of Pharaoh's dream, which Sir Samuel Baker has recently attempted to explain by supposing that the Abyssinians had dammed up the Atbara river. It is not an uncommon belief among savages that as a man dies so he will rise again, and that this applies to the body as well as the mind. Moreover, the way to the land of spirits was long, dangerous, and beset with demons. Many perished on the way, and no one who was not in possession of all his faculties could hope to arrive in safety. So convinced were the Fijians of this, that as soon as a man felt the least sign of old age he was anxious to start on his long journey.

Mr. Hunt tells us that one day a young man in whom he took much interest came to him and invited him to attend his mother's funeral, which was to take place the next morning. Mr. Hunt accepted the invitation and went. As he walked along in the procession he was surprised to see no corpse, and asked the young man where his mother was, when he pointed to a woman who was walking along just in front, to use Mr. Hunt's words, "as gay and lively as any of those present.

"When they arrived at the grave she took an affectionate farewell of her children and friends, and then submitted to be strangled." So general, indeed, was this custom in the islands, that in many villages there were literally no old people, all having been put to death; and if we are shocked at the error which led to such fearful results, we may at least see much to admire in the firm faith with which they acted upon their religious belief.

Our New Navy.

The gunboat Petrel is being built by the Columbia Iron Works, of Baltimore, and is nearly complete in every respect. None of her machinery will be put aboard prior to launching, as it is the desire of the contractors to have as little weight as possible on the ways. The boilers and engines are all ready, and will be placed on the ship very soon after she is launched. The Petrel will be barkentine rig, steel hull, and of about 885 tons displacement. She will carry four guns in her main battery, besides several machine guns on deck. It is expected that the ship will be turned over to the government complete in every respect about the latter part of December.

The work on the Chicago still continues at the New York yard, and it is hardly probable that she will be put in commission much before the first of next year.

The double-turreted monitor Amphitrite was lately taken out of the dock at Wilmington, Del. Her bottom has been painted and otherwise fixed up. The department has as yet reached no decision as to whether the ship will be rebuilt at a private yard or at some navy yard.

The new cruiser Charleston, now building at San Francisco, Cal., will be completed about January 1, the contract time, as the department is in receipt of reports from the contractors saying that the work is progressing very rapidly, and that the ship will be turned over to the government at the time specified. Of course she will be assigned to the Pacific station, and will be the flagship.

The Philadelphia *Inquirer* says: "The Philadelphia, it is expected, will beat the Baltimore in speed, as Messrs. Cramp will supply their own engines to the former, whereas the firm of Humphreys & Tennants, England, will provide the motive power for the latter. In the one case Messrs. Cramp guarantee a speed of nineteen knots, in the other they only guarantee horse power. It will be interesting to compare the work of the two sets of engines when both vessels are in commission. The model of the Philadelphia, although an English design, is considered by the Messrs. Cramp to be a very good one, and capable of but little improvement in view of the work the vessel will have to perform.

"The dynamite cruiser Vesuvius was sent down the river October 1 to try how the engines worked. The affair was kept very quiet, only a privileged few being notified of the event. So far as could be learned, the trial was a most successful one, the vessel showing extraordinary speed, making a run of 13½ miles in 29 minutes, being an estimated speed of nearly 27 miles an hour. As the guaranteed speed is only 20 knots an hour, this, if correct, is eminently satisfactory. Allowance has, however, to be made for the tide, which would deduct about two knots off the record, but even then the result exceeds the expectations of the builders."

We learn that everything worked well on this trial. There was no heating of journals and no leaks anywhere and very little vibration. Two hundred and forty revolutions were reached without effort, but no measurements of speed were taken, as the trial was only made to find defects in the engines, if any existed. One of the builders has written to an officer of the War Department that a speed of 20 knots was obtained with a pressure of only 135 pounds. All indications point to additional speed when the full working pressure of 180 pounds is put on, and it is then expected fully 23 knots will be made.

In the naval appropriation bill approved September 7, 1888, provision was made for the construction of seven new vessels, and an appropriation of $5,550,000 was made, and an additional appropriation of $260,000 for a composite ship to be used as a practice vessel for the midshipmen at the Naval Academy. Secretary Whitney has now under consideration a number of designs for these new ships, and as soon as the designs are adopted, work will be immediately started on the plans and specifications, and the contracts awarded.—*Army and Navy Journal.*

An Application of the Phonograph.

R. J. Hewett, in the *Electrical World*, says: The phonograph seems to be a promising auxiliary to the Wheatstone automatic system. The phonograph can be substituted for the ink recorder, and the signals read off by a Morse operator at his leisure at lower speed. The phonograph motor would require two different speeds—a high speed for receiving the automatic telegraph signals and a slow speed for reproducing to the Morse operator. The slow speed should still further be variable within a smaller range, so as to suit the ability of the receiver. Thus the automatic and manual service would be combined, the automatic being used for transmission, while the manual service, aided by the phonograph, can be employed for receiving.

PAVILION OF THE REPUBLIC OF CHILI AT THE PARIS EXPOSITION OF 1889.

Since the opening of the preparatory period of the Universal Exposition of 1889, a large number of foreign countries, desirous of participating in it brilliantly by the erection of structures worthy of the part that they are to play, have decided to put their projects out to competition in order to utilize the capacity of the most renowned specialists, and, by skillful selection, reach as perfect results as possible. Among the most remarkable competitions may be mentioned the one opened by Chili for the erection of its pavilion. There were three French firms of builders who obtained the rewards offered by that republic, and, of these, Messrs. Moisant, Laurent, Savery & Co. obtained the first prize and were awarded the work.

The location accorded to the Chilian government consists of a quadrilateral of 65 by 80 feet, situated at the angle of the small park of the Champ de Mars to the right of the Eiffel tower with respect to a visitor standing upon the bank of the Seine and turning his back to the Trocadero.

The conditions of the competition were particularly severe, and, in order to show how they were carried out by the successful architects, we present herewith, from *Le Genie Civil*, a view of the front of the adopted plan

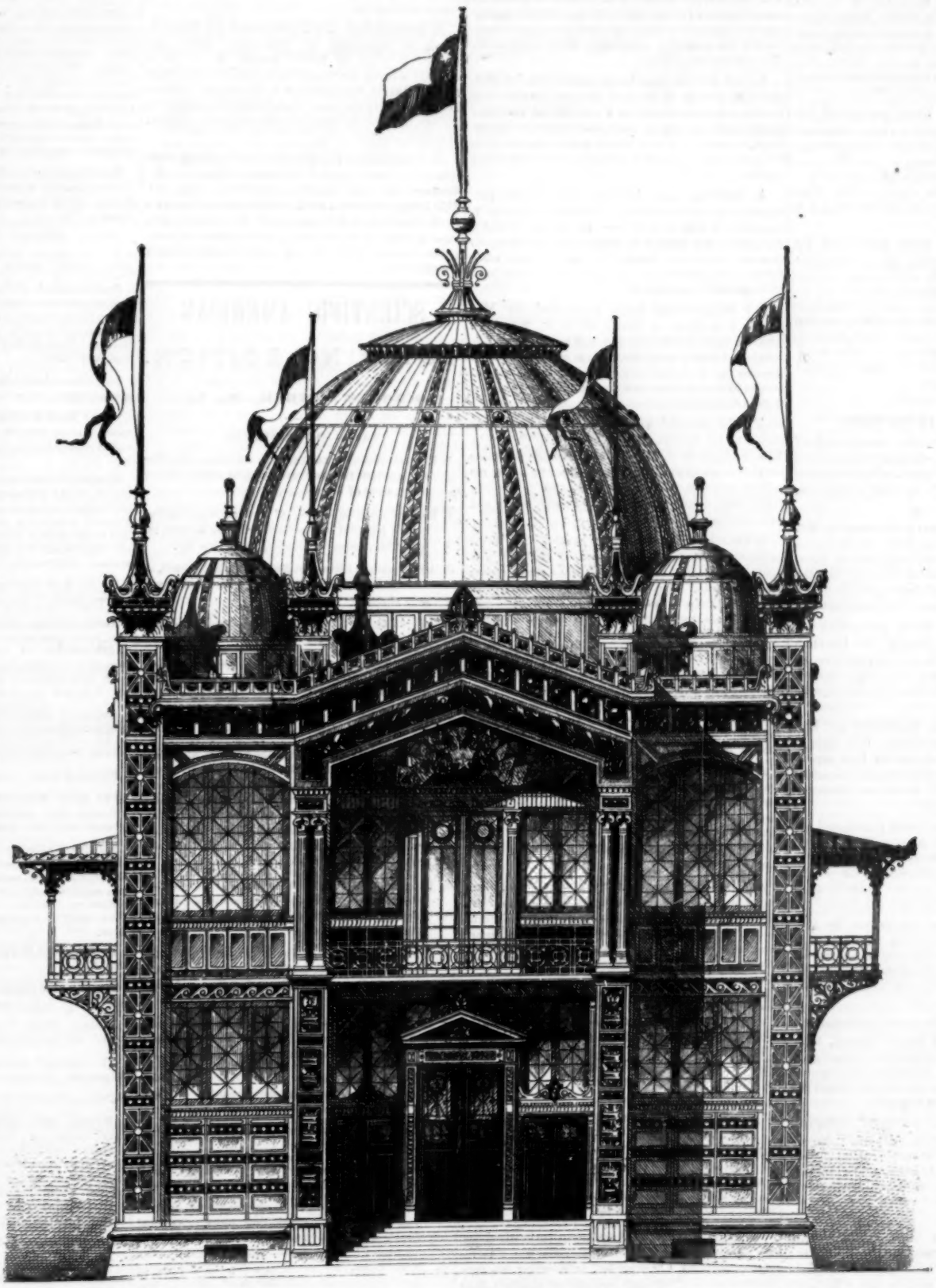
The building consists of a central structure surmounted by a dome and flanked by four rectangular towers, surmounted by small domes which are surrounded by decorative capitals placed upon the uprights of the towers, which themselves consist of metallic caissons whose faces are provided with terra cotta panels.

The entrance, which is formed of a projecting portico extending to the top of the building, gives the latter the truly monumental character required by the specifications. A flight of steps of the whole width of the portico leads to the peristyle upon which open the bays, giving direct access to the interior of the edifice. These bays are three in number, one large central one and two small ones all having folding doors to prevent entrance and exit from being impeded. The side opposite the entrance has a projection representing a large winter garden, intersected midway by a balcony communicating with the gallery of the first story. Balconies, in fact, exist on every side, for the portico likewise has one, as well as the sides of the pavilion, but these latter ones project from the facade, and each has a roof and supporting columns, giving it the aspect of a veranda.

In addition to iron, the use of which was made obligatory, and which the builders have used not only as a framework, but also for decorative purposes, in various parts of the edifice, the materials that enter into the structure are terra cotta, compressed beton, bricks, tiles, slabs of plaster, and wood, the latter in very small proportion and only where the use of it was indispensable. Naturally, all these materials are employed either in panels or in portions of very definite form, in order to render the taking down of the structure in France and its re-erection in Chili as rapid as possible.

In order to give the structure great stability, as well as great rigidity, and at the same time save material, the architects have made their framework double walled, with an intermediate space. This system has also the advantage of protecting the interior of the halls against the differences (often excessive) that the external temperature is subject to.

It is to be hoped the United States will not be backward in providing a suitable national pavilion. We believe no steps have yet been taken. If anything is to be done, it should have immediate attention.



PAVILION OF THE REPUBLIC OF CHILI AT THE PARIS EXPOSITION OF 1889.

Idaho Streams that Vanish.

One of the peculiar features of Idaho scenery is the frequent occurrence of dark rocky chasms and channels of lava into which streams and rivers plunge and are apparently forever lost.

These fissures are supposed to be old lava beds. The outside of the molten mass cooled and formed a roof, the fiery stream below became exhausted, leaving an empty chamber. A break in this roof having occurred, an opening was formed into which the river or stream now disappears, to reappear as a mysterious lake, basin or spring on some distant mountain or plain.

On the banks of the Snake River one of these streams reappears, gushing from a high cliff in a cataract to the waters below.

The Practical Limit of Speed.

The highest speed practically attainable in daily service with passenger trains has always been a point on which much discussion has been raised. The recent race between London and Edinburgh seems, however, to afford a tolerably complete solution of the problem. The official figures, giving the actual time and load for each day of the run, when analyzed, give the following average results for the London and Northwestern route from Aug. 6 to Aug. 31 inclusive. During this time the schedule time was 8 hours for the 400 miles, and the train arrived in Edinburgh ahead of schedule time on 22 days and was 37 minutes late on one day only, owing to a flue on the locomotive collapsing. With this exception, the running was remarkably regular, the trains arriving within 1 minute for 11 days in succession. The average speed for the whole period was a fraction over 50 miles per hour including stops, and slightly under 55 miles per hour excluding stops. The average time occupied in the three stops was 40 minutes, one stop being for dinner. The train consisted of four eight-wheel cars, with F. W. Webb's radiating axles. The cars were each 42 ft. long over bodies and weighed 42,500 lb. each. Three different classes of engines, weighing respectively 61,000, 76,000, and 94,000 lb. in working order, were employed on different portions of the route, the lightest engine running over the lightest grades. The minimum weight of engine, tender, and train was 287,000 lb. and the maximum 339,000 lb., the average being 305,000 lb. The grades varied considerably, the worst being one 9½ miles long averaging 67 ft. per mile, and another 4¼ miles long of 70 ft. per mile. The best performance over the section containing the former grade was 101 miles in 104 minutes (which was done on three occasions), and over the latter 90 miles in 90 minutes, in both cases from start to stop. The fastest run over the more level portion was 158 miles in 166 minutes, start to stop, or 14 minutes under schedule time. The feat appears to have been so easily performed that on the Northwestern it was not considered necessary to employ the compound engines, and the fast running was done with comparatively old engines of far less weight and power than the compounds, which were reserved for the heavier trains. These facts merely emphasize what has repeatedly been urged in these columns—the importance of good signals, which aid fast running far more effectually than heavy engines.

It will thus be seen that with a light train, stoppages averaging 100 miles apart, good permanent way, and somewhat severe grades on the northern portion of the journey, a speed of 50 miles per hour, including stops, was maintained with ease. This certainly marks a considerable advance on previous practice, and shows that where sufficient inducement offers, modern railroad appliances are capable of approaching very closely to the apparent limit of a mile a minute.—*Railroad Gazette.*

ENGINEERING INVENTIONS.

A valve for engines has been patented by Mr. James Des Brisay, of Kamloops, British Columbia, Canada. Combined with a valve adapted to rotate on its seat, and having a concentric projection, is a ring held on the projection and pressing against the valve, with other novel features, the valve being operated directly from the main shaft.

A car dumping device has been patented by Mr. Daniel T. Denton, of Tower Mines, Minn. This improvement is specially adapted for cable cars loaded with ore, coal, or other material, and covers a novel construction and combination of parts by which the loaded cars are easily, quickly, and automatically dumped.

A car coupling has been patented by Mr. Simon J. Freeman, of Rochester, N. Y. The drawhead has a projection in its bottom, behind which is a recess, combined with a vertically sliding and longitudinally swinging arm extending up through a slot, with other novel features, whereby the coupling and uncoupling of cars may be readily effected without going between them.

A car coupling has been patented by Mr. David N. Tarbox, of Cedarville, Ohio. Combined with a drawhead in which is journaled a hooked coupling link is a transversely swinging weighted operating arm extending through the drawhead and having a limited movement through the coupling link, there being a pivoted retaining cam on the arm adapted to bear on the drawhead.

A steam boiler has been patented by Mr. George Kingsley, of Lowell, Mass. Combined with a double shell horizontal boiler having an inner and outer fire space and a water space between are inclined laterally projecting tubes screwed into the inner shell, having their inner ends closed and elevated and projecting into the inner fire space, stay bolts alternating with the tubes and connecting the shells, the invention covering an improvement on former patented inventions of the same inventor.

MISCELLANEOUS INVENTIONS.

A lotion to be used in the treatment of sores has been patented by Mr. Thomas Tomlinson, of Clarinda, Iowa. It is made of gambier, salt, sulphuric acid, and water, compounded in specified proportions, and used as directed.

A ratchet drill has been patented by Mr. Peter B. Erickson, of Ishpeming, Mich. The invention covers a novel construction and combination of parts, whereby the drill may be readily inserted and the action of the drill reversed, and wherein also the device will be durable and can be conveniently manipulated.

A vehicle spring has been patented by Mr. Edwin Jarrell, of Harper, Kansas. The invention consists in novel constructions and combinations of parts designed to render available in a simple manner the square torsion of the spring bars, with other special features.

A latch bolt has been patented by Mr. Franz Spengler, of Berlin, Germany. It is made in wedge-like form, having its end beveled from edge to edge and from side to side, being designed to reduce the friction between the head of the bolt and the keeper on the door casing to a minimum.

A shingler's gauge has been patented by Mr. Franklin P. Sanborn, of Standish, Me. This invention covers a device of novel construction to be used in applying shingles or clapboards to the roofs or walls of buildings for determining the proper position of each course with respect to the preceding course.

A mole trap has been patented by Mr. Samuel J. Grimmett, of West Plains, Mo. Combined with set or fall sticks a board is used having pins on one side and a longitudinal knife on the other, the pins being adapted to impale or imprison a mole, and the knife for destroying snakes.

A bucksaw frame has been patented by Mr. Joseph W. Thompson, of Mount Pleasant, Iowa. The invention covers a novel construction and arrangement of parts and details for an improved saw frame in which each of the end pieces is made of a U-shaped bar so as to combine lightness with strength.

A wall protector, to prevent defacing of walls by furniture, has been patented by Messrs. Roldin S. Robbins, of San Francisco, and Alphonzo H. Broad, of Berkeley, Cal. It consists essentially of an elastic button with surrounding flange, to be used with a retaining band or wire, to protect both the walls and furniture.

A garment stay has been patented by Mr. Edward K. Warren, of Three Oaks, Mich. It is a covered stay for dresses or other garments, having a stiffening strip covered by separate pieces of fabric projecting beyond the side edges, and there stitched to form selvedges through which the seamstress may stitch and secure the stay to the garment.

A weather board holder and gauge has been patented by Messrs. Madison G. Stanley and William F. Jones, of Kenton, Tenn. The device is simple and easy of manipulation, and is designed to dispense with driving nails in the previously put on boards, while affording means for expeditiously gauging the amount of lap to be allowed.

A crutch attachment has been patented by Mr. William J. Donald, of Tunnel City, Wis. This invention covers an improvement in that class of crutches which have an elastic foot and a spar, either of which may be adjusted for use alone by resting the foot on the ground or floor to screw or unscrew it, thereby projecting or withdrawing the spar.

A magic lantern slide has been patented by Mr. Edward T. Potter, of Newport, R. I. It consists of a continuous band or strip of flexible transparent or translucent material, carried by reels or spools, upon which the views or figures are portrayed, combined with a motor for drawing the band through the lantern from one reel to another.

A portfolio for maps, periodicals, etc., has been patented by Mr. Henry A. Hayden, of New York City. It has a series of fastening devices arranged on the inside of the covers, and consisting of overlapping metallic strips hinged to staples, being designed to display maps, time tables, etc., in prominent places.

A hammock has been patented by Mr. Barry A. Norris, of Houston, Texas. It is made with slats, each provided at its ends with a transverse aperture through which passes a cord or wire for holding the slats together, making a hammock designed to be simple and durable and yielding to the motion of the body.

A wheeled dumping scraper has been patented by Mr. Cyrus A. Kenney, of Nicholasville, Ky. The scoop is adapted to be lowered to present its scooping edge to the ground for filling, while it may be raised to a greater or less height and be dumped backwardly, the invention covering a novel combination and construction of parts.

A pay device has been patented by Mr. David W. Bundy, of Toronto, Ontario, Canada. The invention consists mainly of a tray having a series of pockets, each bearing the name and number of an employe, in connection with money boxes adapted to be received in the pockets and bearing a corresponding number.

A heating gas burner has been pa-tented by Mr. Albert J. Doty, of Philadelphia, Pa. It is made of a disk of sheet iron, in the edge of which flaring slits are formed, the disk being swaged up so that the edges will be beveled and the slits made narrow, with parallel edges, making the desired form of orifice for the gas and air.

An image has been patented by Mr. Charles I. D. Looff, of Gravesend, N. Y. It is made with an inner wooden section and outer plastic side sections, whereby great strength is obtained and the muscles can be brought out naturally, as desired for images or figures of animals to be used in connection with carrousels or merry-go-rounds.

A chill mould apparatus has been pa-tented by Mr. William Fawcett, of Jersey City, N. J. It is an apparatus for casting sash weights or similar articles, in which the moulds are chilled by water, the hollow sectional moulds being arranged in a rotary frame about a hollow axle having a water supply and exit pipes suitably attached.

A geometrical drawing board has been patented by Mr. James M. Pringle, of Bathurst, New South Wales. This invention provides a simple means for facilitating the teaching and explaining the principles of that branch of solid or descriptive geometry used in construction, also illustrating these principles in the teaching of mechanical drawing.

A lock hinge has been patented by Mr. Leonard Tilton, of Brooklyn, N. Y. It consists of a vertical plate, with a slotted horizontal plate, in combination with a pivot bolt held in the slot, an arm, rack, and locking bolt being held in an aperture in the window frame, making an improved fastener for window blinds, etc.

An apparatus for casting metal ingots has been patented by Mr. William Huffelmann, of Germaniahutte, Prussia, Germany. It is for casting small ingots suitable for the manufacture of wire, etc., and designed to produce great density at their outer part, with as little loss as possible from waste in the runner and gates.

An attachment for bicycles has been pa-tented by Mr. Herman H. Holtkamp, of New Knoxville, Ohio. It consists of a runner or shoe arranged for connection with the small wheel of the vehicle, with bearing plates which may be clamped to the peripheral face of the driving wheel, whereby the machine may be run upon ice or snowy ground.

An ice cutting machine has been pa-tented by Messrs. Louis C. Hartung and William A. Haussener, of Stillwater, Minn. The frame is mounted at the rear on wheels and in front on runners, the turning of the wheels, which are spiked, acting on a shaft to drive a saw, the weight of the frame forcing the revolving saw down into the ice.

A drag saw has been patented by Mr. John Harrigan, of Brooklyn, N. Y. It is designed for cutting off the upper ends of piles and similar uses, and combines with a support to be fastened to the pile a yoke pivoted on the support, and having parallel ways adapted for the saw to slide therein, the saw having a handle set at an angle to the face of the blade.

A journal bearing has been patented by Mr. George L. Griswold, of Bellows Falls, Vt. This invention provides a bearing box or reservoir having a network of oil or lubricant passages or channels in it, at a number of the intersecting points of which are cavities or receptacles, the device being adapted for lubricating flat as well as convex or cylindrical surfaces.

A toilet paper cutter has been patented by Mr. Henry H. Harrison, of New York City. It has a stationary blade, with rollers for drawing the paper from a drum, in combination with a pivoted blade and springs, and other novel features, whereby the paper may be conveniently drawn out and cut off in the desired lengths.

A velocipede has been patented by Mr. John Hagan, of Atlantic City, N. J. Combined with the main axle and driving wheels, springs are so secured to the main frame that power may be stored up therewith, by means of a crank arm, and can be used as desired in propelling the velocipede, provision being also made for the use of an electric motor and batteries.

A rowing gear has been patented by Messrs. Oren Tippy and Fred D. Smith, of New Carlisle, Ind. This invention provides a device by means of which a boatman may pull a boat in the direction in which he is facing, it being designed that every motion requisite in rowing may be obtained by the use of the device, while the oar can be manipulated with efficiency and ease.

A brick machine has been patented by Mr. Robert A. Willett, of South Amboy, N. J. This invention covers a novel construction, combination, and arrangement of parts in a machine in which the clay is compressed in the form of bricks by different plungers, and in which the pressure may be adapted to different qualities of clay and the slow or quick movement of the plungers in the mould boxes be regulated.

A gate has been patented by Mr. John W. Rutledge, of Shannondale, Ind. It is designed to be opened and closed by a person in a vehicle or on horseback, and is constructed to prevent snow and ice interfering with the action of the catches, and to render more effective and simple the means of actuating the latch, while the gate may readily be tightened and braced as required.

A wrench has been patented by Messrs. Albert M. Spaulding, of Flowerfield, Mich., and Herbert L. Case, of Bristol Center, N. Y. It is specially adapted for conveniently unscrewing the nuts of vehicle axles, and comprises a bar having a wrench head between its ends and arms mounted adjustably on the bar, the opposite ends of each arm being adapted to engage a spoke.

A breasting attachment for heeling ma-chines has been patented by Messrs. Martin C. McGeuness and John Tweedie, of Jefferson City, Mo. This invention covers a novel combination and arrangement of parts in a device designed to accurately trim the inner edge of the heel of a boot or shoe, without cutting the sole, while the top piece is put in place at the same time.

SCIENTIFIC AMERICAN BUILDING EDITION.

OCTOBER NUMBER.—(No. 36.)

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3. A residence at Richmond Hill, N. Y., lately built, at a cost of ten thousand dollars. Perspective and floor plans.
4. A dwelling for three thousand five hundred dollars. Floor plans and perspective.
5. Villa at Fontainebleau—M. E. Brunnarius, architect. Cost, eight thousand six hundred dollars. Floor plans and perspective.
6. View of the new Protestant church at Lyons, France. Cost, eighty thousand dollars.
7. Page of engravings showing the house at Stratford-on-Avon in which Shakespeare was born—Anne Hathaway's cottage, near Stratford-on-Avon—Trinity Church, Stratford-on-Avon, where Shakespeare is buried—The residence of Mary Arden, the mother of Shakespeare—Old Elizabethan house, Stratford, showing the domestic architecture of the time of Shakespeare.
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Lockwood's Dictionary of Terms used in the practice of Mechanical Engineering, embracing those current in the drawing office, pattern shop, foundry, fitting, turning, smith's and boiler shop, etc., comprising over 6,000 definitions. Edited by a foreman patternmaker. 1888. Price, $3.00. For sale by Munn & Co., 361 Broadway, New York.

Duplex Steam Pumps. Volker & Felthousen Co., Buffalo, N. Y.

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Wrinkles and Recipes—Compiled from the SCIENTIFIC AMERICAN. A collection of practical suggestions, processes, and directions for the mechanic, the engineer the farmer, and the housekeeper. Illustrated colored frontispiece. Edited by Park Benjamin, Ph.D. Third edition. Price, $2.00. For sale by Munn & Co., 361 Broadway, New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Double boring machines. Double spindle shaping machines. Rollstone Machine Co., Fitchburg, Mass.

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NEW BOOKS AND PUBLICATIONS.

FIRST ANNUAL REPORT OF THE BOARD OF MEDIATION AND ARBITRATION OF THE STATE OF NEW YORK. Commissioners, William Purcell, Gilbert Robertson, Jr., Florence F. Donovan. Transmitted to the Legislature January 16, 1888. The Troy Press Co., printers. 1888. Pp. 734.

In this report of the Board of Mediation and Arbitration of the State of New York the condition of several branches of manufacture, as revealed in the examinations of operatives and employers by the Senate committee, is given. The work is an interesting one, despite the unattractive form of question and answer in which most of it is necessarily presented, and many of the

revelations of the examination as to the small amount of wages earned by immensely long hours of work are very sad. It is published by the State, and it would be well if its contents were read and studied by all who have a direct or indirect interest in the cause of the many.

THE CHEMICAL ANALYSIS OF IRON. A complete account of all the best known methods for the analysis of iron, steel, pig iron, iron ore, limestone, slag, clay, sand, coal, coke, and furnace and producer gases. By Andrew Alexander Blair. Philadelphia: J. B. Lippincott Co. 1888. Pp. 282. Price $4.

This excellent treatise is devoted primarily to the analysis of metallic iron; this is given in detail with all the determinations and the different methods of effecting them. The analysis of iron ores is treated in a special chapter, and then the analysis of allied substances is spoken of, such as limestone, clay, slags, fire sands, coal, and coke, and furnace gases. A chapter of tables giving atomic weights, factors, etc., concludes the work. It is very well illustrated by nearly 100 cuts of apparatus, and a satisfactory index is given. It can be recommended, not only on account of its author's high reputation, but also on account of its contents, to all chemists interested in the analyses of blast furnace and rolling mill and steel works material.

THE LIXIVIATION OF SILVER ORES WITH SPECIAL REFERENCE TO THE RUSSELL PROCESS. By Carl A. Stetfeldt. New York: Published by the author, 18 Broadway. Pp. xx, 234.

The title of this book discloses its nature. It is in effect a very extensive and elaborate monograph, and one which will undoubtedly be of value to all who are specially interested in this process. It is illustrated by a number of cuts showing the different apparatus employed in the process treated of, while many figures, tables of results, etc., contained throughout the work add largely to its value. It is indexed, and the cuts already alluded to—thirty in number—embodied in the text are supplemented by several folding sheets showing the arrangement of different portions of the lixiviation plant treated of in the work.

RAILROADS AND ROLLING STOCK. A catalogue giving cost of plant and material for portable, light, and main lines, to which is added a chapter on river steamers and light craft, also dredging plant. Prepared by John Birch & Co., engineers and merchants, Liverpool. Pp. 232.

All that can be said of this catalogue is that it describes, notes, or illustrates almost everything that can be thought of under its title. Although a trade catalogue, it forms a very convenient and attractive manual for those interested in railroad and machine engineering.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. F. asks how to make a good flash light for photographic purposes. A. Purchase one ounce of magnesium powder and one ounce of negative gun cotton from dealers in photographic materials. Place on a dust pan enough cotton, when pulled out, to measure about 3½ inches in diameter. Sprinkle it over with twenty grains of magnesium powder to form a thin, even film. Lay over the magnesium thus arranged a very thin layer of gun cotton. Connect to the bunch of cotton a small fuse of twisted cotton about six inches long, so that it will extend to the side of the dust pan. Then set the pan on a step ladder near the object, and when ready, light the gun cotton fuse with a match, when instantly a brilliant flash will ensue. There are several ready prepared magnesium compounds now sold with special devices and lamps to fire them.

(2) J. C. asks for a receipt for removing mildew from white silk. A. Perhaps naphtha will do it. Take to dye house, or try following: Dip a piece of flannel in alcohol and water, and well rub the place; iron on wrong side, putting a piece of damp cotton cloth between the iron and the silk.

(3) E. F. Co. write: We recently noticed an article in SCIENTIFIC AMERICAN upon the subject of size of fire box under boilers to give best results, and stating that the fire boxes are usually too large. We have suspected that we used too much fuel, and want to ascertain what size our grate between door and bridge wall ought to be under our boiler, 13 feet 6 inches long, 5 ft. diam., 84 tubes 2¼ inches, steam pressure required 80 pounds. A. The amount of grate surface required for your boiler is dependent upon the amount of steam required, which you do not mention. The article in question alludes to the construction of boilers of full capacity for the work to be done. If a boiler with large grate surface can only keep up the steam required by strong firing, there is nothing gained by reducing the grate and urging a still stronger fire. It is where the boiler is of larger capacity than the steam requirement that the gain is made by reducing the normal grate surface to the proportions mentioned in the article alluded to. Really, the great economy is made in having the boiler at least 50 per cent larger than the steaming capacity required, as usually computed. Then with a reduced grate surface and quick fire the utmost economy will result. The whole gist of steam economy is in saving the waste heat of the chimney and the exhaust. Of course proper care must be taken to prevent loss of heat from exposure of steam-heated surfaces around boiler, pipes, and cylinder. Before we can advise a reduction in your grate, we should know the temperature of the gases of combustion as they leave the heating surface. The difference between this temperature and the temperature of the steam will indicate the waste. Also, we should know if the present firing is strong or dull; it being a most important factor in making a change for economy to know the relative proportion of heating surface in the boiler to the amount of steam produced or work done. It is a most common practice to urge a boiler to excessive duty and then complain of excessive coal consumption. We can only advise that, if you desire to make an experiment of any real value, you accurately weigh the fuel used for a day, or better for a week. Then put a row of fire brick on each side of the grate, three or four bricks high, making your actual grate surface 9 inches narrower. By urging the fire with the fuel weighed as before for a definite time—a day or preferably a week if you can—you may have an absolute test of the economy of the change in your case. If you succeed, your boiler is large enough for your wants. If not, the conclusion is that for economy you should have a larger boiler. The art of firing is an essential feature in steam economy, too often overlooked in the complaints as to fuel consumption. A difference of ten per cent or more may be made by variation in the management of doors and dampers.

(4) P. I. J. asks: 1. Can a wine artificial in its make-up, or that has been colored or improved by ethers, be easily distinguished from a natural wine? A. It is sometimes very difficult to do. The aniline colors are tested for, and special tests applied for suspected adulterants. 2. Where may a full account of the various fruit ethers be obtained? A. These have to be studied in chemical treatises. There is no work devoted exclusively to them. 3. In making a vanilla extract, difficulty in completely pounding the bean to a pulp in a mortar is experienced. Can you tell an efficacious method? A. Add white sand, and pulverize sand and beans together. 4. Are there any special colognes that are made, usually by simple solution of the oils in the cologne spirits, that would be improved on distillation? A. We know of none. 5. Which would make the best emulsion of wax—Castile soap or caustic potash? A. Neither will answer. Try dissolving the wax in oil and making an emulsion of the product with water and gum tragacanth.

(5) G. A. J. asks: 1. What is used for a gold bronze for wood, and how applied? A. The preparation is sold as a powder, and is applied mixed with a suitable varnish, or the surface is first varnished and the powder applied with a pad while the varnish is still tacky. 2. Does the use of mica oil in boilers lessen the heating capacity? The oil is used for the prevention of scale, etc. A. Not to any appreciable extent, unless used in large quantities. The boiler should be blown off from time to time. There is some danger of corrosion. 3. How to sugar-cure beef. A. Cure for 10 or 12 days with dry salt to which a little saltpeter has been added, along with some sugar and black pepper. It is then hung up until required. Folded in dry paper and hung in a dry place, it will keep two or three months. 4. Is there any way to temper brass wire after it has been hot? A. Light hammering, redrawing to a slightly smaller size, heating followed by a very slow cooling, all tend to harden brass. 5. What is the price of platinum, such as used in wire, etc.? Is it used as coin in some countries? A. $9.00 an ounce. It has been used in Russia for coinage.

(6) C. G. H., of Wallingford, Conn., sends two worms found on a snowball bush. When they touch the hand, he says, it is badly nettled and inflamed for a few days. What is it? A. Professor C. V. Riley says they are larvæ known commonly as saddle-backed caterpillars. They are the larvæ of a moth known as *Empretia stimulea*, which is comparatively common almost all over the country. The larvæ feed upon a great variety of plants, but are perhaps found more often upon corn than upon anything else. They belong to the group of stinging caterpillars, and the effect of their spines upon the skin is similiar to that of a nettle.

(7) A. S. E. asks (1) how to deodorize wood alcohol to fit it for burning? A. No efficient and cheap way is known. 2. What cement will secure wood firmly to glass, same carried by wheel applied to one side. A. Use bicycle tire cement, or dissolve 1 part India rubber in 12 parts benzine and add 20 parts of shellac and carefully heat until benzine is expelled. There is much danger of the benzine igniting. 3. How to make the aniline colors, getting them in the crystal forms. A. You can buy aniline colors from the dealers in chemicals.

(8) W. B. K.—The terms "cold-blooded" and "warm-blooded," as applied to human beings, refer principally to the excitability or non-excitability of the individual, and not really to any difference in the heat of the blood. The temperature of the heart circulation in all persons in health is about 98° Fah.

(9) I. A. C. desires a receipt to make marking ink, black and red, either or both, to mark cotton bales and sacks. It must be cheap, as we sell by the barrel. A. Take of shellac 2 parts, borax 2 parts, water 25 parts, gum arabic 2 parts, and of either lampblack, Venetian red, or ultramarine a sufficiency. Boil the borax and shellac in water till they are dissolved, and withdraw from the fire. When the solution has become cool, complete 25 parts with water and add the coloring matter to bring the ink to suitable consistence. When it is to be used with a stencil, it must be made thicker than when it is to be applied with a brush.

(10) T. R. M. asks a formula for charging Babcock's fire extinguisher. A. The extinguisher is charged with a solution of bicarbonate of soda in water and sulphuric acid in a glass bottle, the latter, when required for use, being crushed with a screw, spilling the acid into the charge of soda and water. Carbonic acid gas is instantly generated, by which a pressure is obtained sufficient for throwing the whole contents of the apparatus with much force through a nozzle for fire-extinguishing purposes.

(11) J. E. L. Co. asks how to cleanse sponges of the sand and white particles found in them as they are sold by the trade. A. Shake and wash, with a little hydrochloric acid in one of the wash waters.

(12) C. W. B. asks the quickest and cheapest way of putting a fine polish on light-colored woods, such as white holly, etc. A. Rub paraffine on and polish with a white woolen cloth. Mastic varnish is suitable for white holly. Also, bleached shellac makes a good varnish, using 95 per cent alcohol for solution.

(13) D. N. desires a receipt for making mocking bird food. A. Mix together 2 parts corn meal, 2 parts pea meal, and 1 part moss meal (made by drying and grinding the imported German moss seed), add a little melted lard, but not sufficient to make the mixture too greasy, and sweeten with molasses. Fry in a pan for ½ hour, stirring constantly, and taking care not to let it burn; this makes it keep well.

(14) G. H. P. and others.—When a locomotive is drawing a train around a curve, the outside drivers slip backward. When running by momentum only, the slip may be on either side, depending upon the surface condition of tracks or treads, and also upon excess of weight thrown on outer wheels by centrifugal force due to velocity and smallness of curve. When braking up or with reverse steam on curves, the slip is forward on the inner wheels.

(15) J. M. B. asks: Is there any method of giving to the surface of an iron stove a copper or bronze luster that will not be destroyed by the heat, or that could be cheaply renewed from time to time? A. There is nothing in the paint or polish line but plumbago stove polish that will stand the heat. Nickel plating is much used now for ornamenting stoves.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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October 2, 1888,

AND EACH BEARING THAT DATE.

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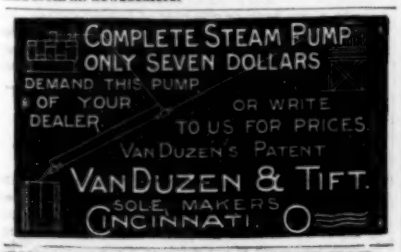

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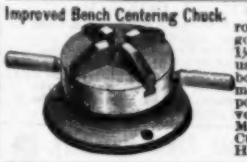

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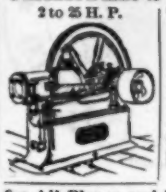

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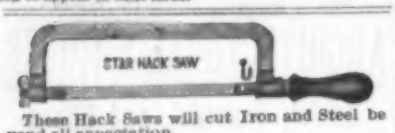

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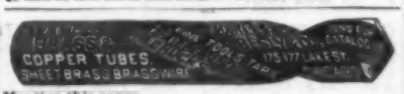

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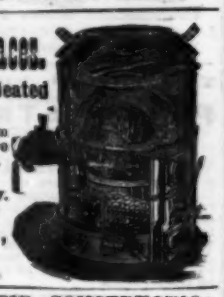

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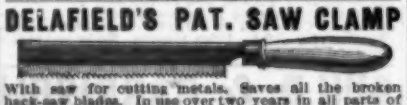

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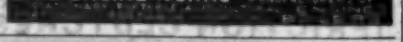

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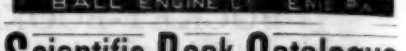

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